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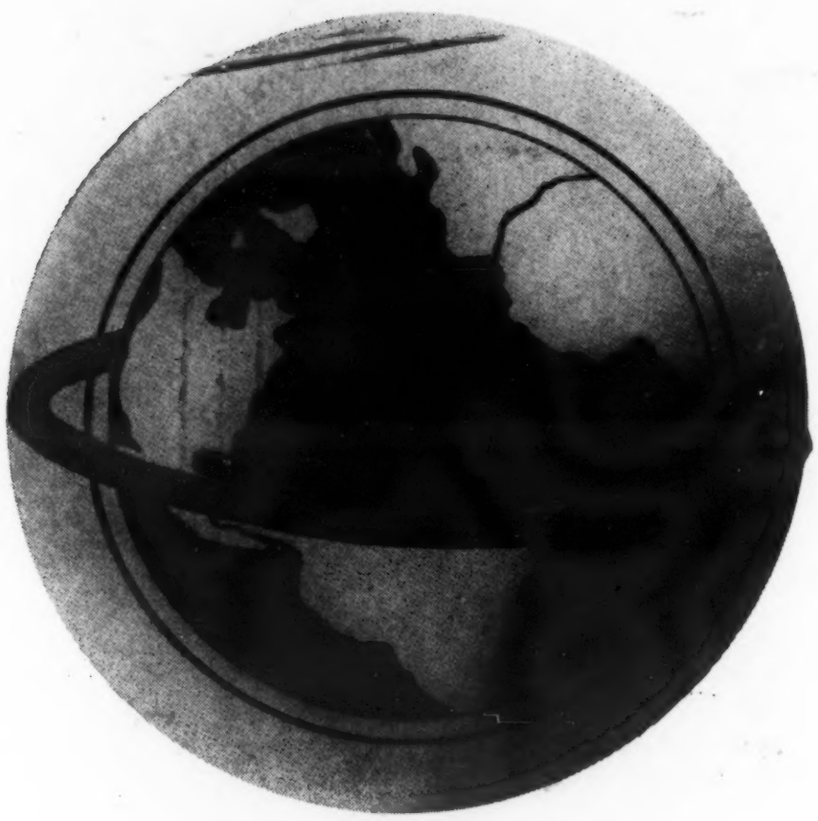
February 1958



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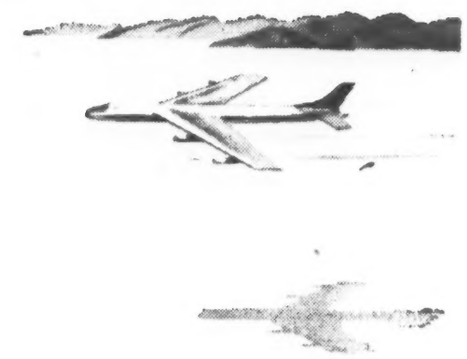

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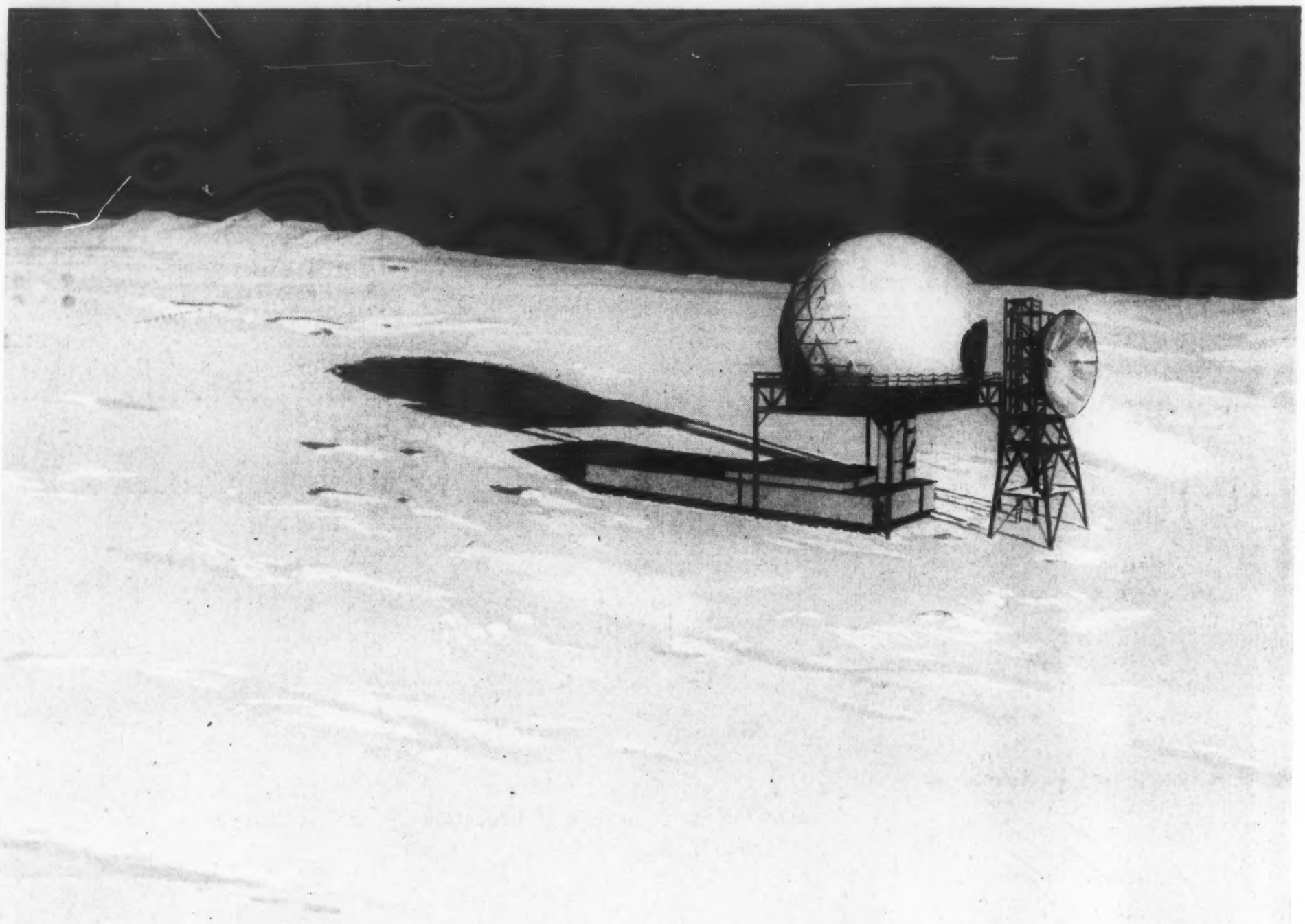

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Journal of the Armed Forces Communications and Electronics Association

VOLUME XII FEBRUARY 1958 NUMBER 6

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*This feature article represents a continuation of the Stockpile Concept (see the January issue) for 1958, stockpiling vital information for SIGNAL readers.

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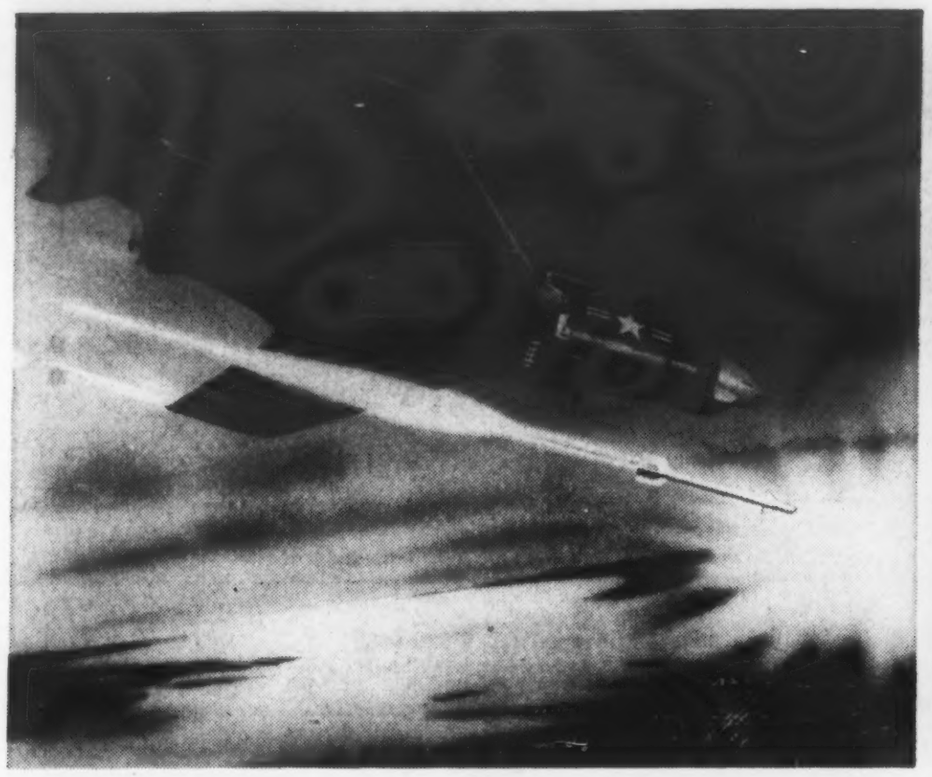
The picture of the missile shown on the cover was furnished through the courtesy of the United States Army. It is the Jupiter C which successfully placed the Explorer in orbit.

Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.



MISSILE COMPONENTS Bulova's infra-red seeker cell—the Sidewinder's eye — locks this missile on target; Bulova fuzing systems do the rest. Powder-driven gyros, timers, safety-and-arming systems and other electronic and electro-mechanical devices, designed and made by Bulova, play vital roles in the Dart, Talos, Sparrow... in all, 18 key missiles.

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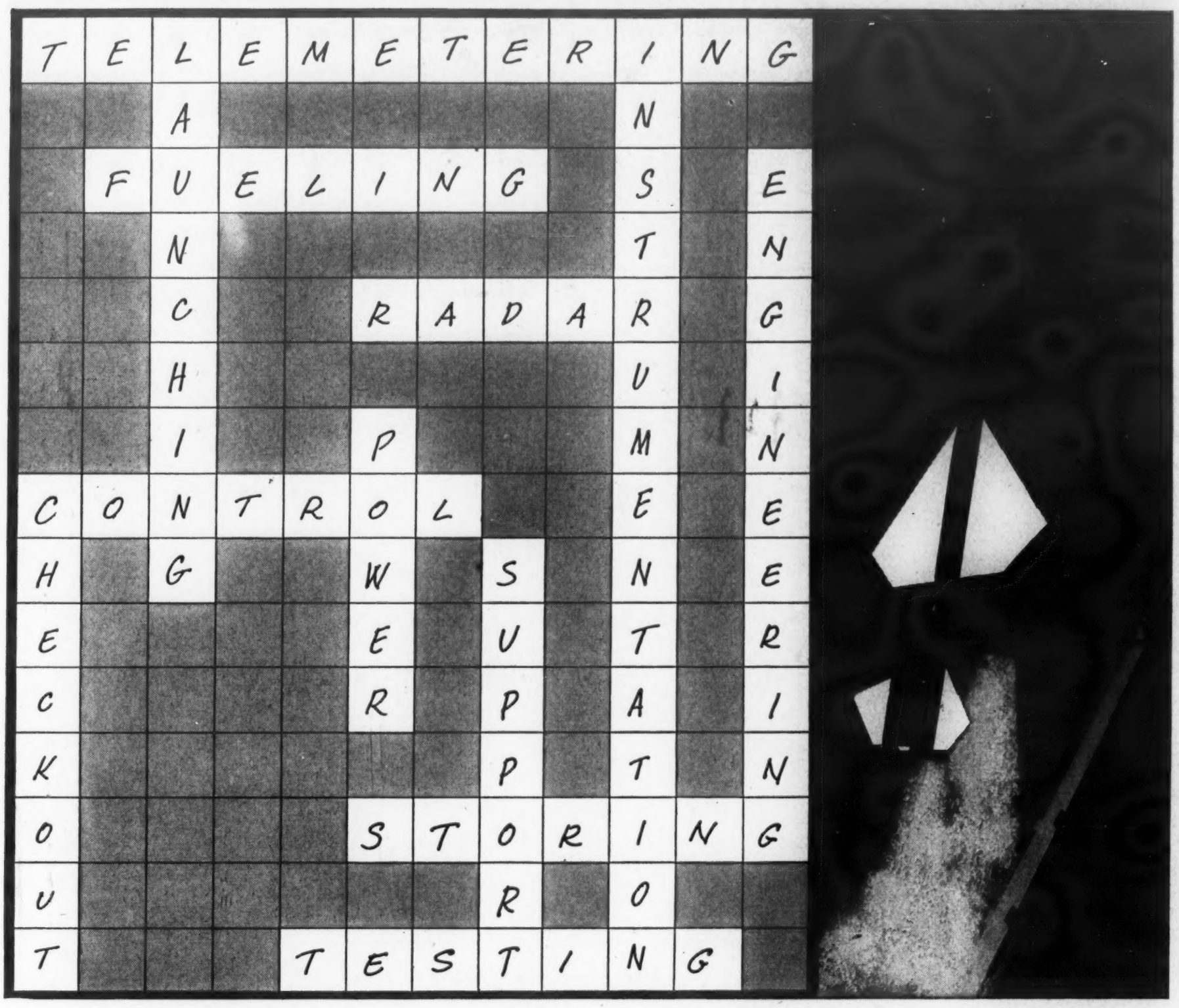

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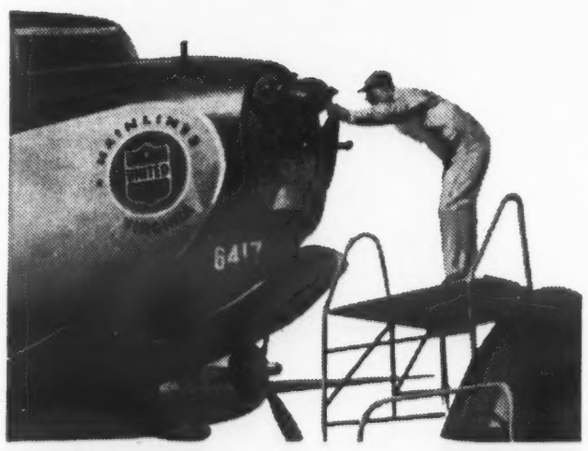
RCA ELECTRONICS KEEPS A RADAR "WEATHER EYE" ON YOUR COMFORT ON THE GREAT AIRLINES



Airlines equipped with RCA all-weather radar include: United Air Lines (DC-7 above), Trans-World Airlines, American Airlines, Continental Airlines, Pan American, Braniff, CAA, Air France, Cia Mexicana, Swissair, Sabena, BOAC, Iberia, RAAF, Air India, Qantas, Cubana, Karhumaki, Real-Aerovias, TCA, Japan Air Lines, Panair Do Brasil, Swedish Nabal Beard, Pakistan Airlines, SAS, Thai Airways Ltd., Ethiopian Airlines, Olympic Airlines.

Flying into a starless night, the pilot's vision may reach a mere 50 yards. Yet he sees a storm brewing 150 miles ahead.

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Credit RCA Electronics for the "Weather Eye" radar that makes all this possible. And United Air Lines' all-radar fleet for being first (among 24 leading airlines) to use this important development.

RCA has also produced radar to guide ships at sea, and track man-made satellites through space. RCA pioneered and developed color TV, produced the world's largest electronic computer, peanut-sized transistors and much, much more.

Progress like this helps explain why RCA *means* electronics—and why electronics means a happier, healthier, more secure future for you.

RCA **RADIO CORPORATION OF AMERICA**

The Honorable

Sinclair Weeks

Editor's Note: The following remarks by the Secretary of Commerce should be of special interest at this time as they contain some hitherto unavailable information on the status of science in the U.S.S.R., particularly in the area of precision measurement.

AS OF TODAY, THE over-all military and economic power of the free world is superior to that of the countries controlled by the Moscow slave-masters. Some of our own professional calamity howlers may not think so. But Moscow *does*. Nevertheless, the cold facts about Communist plans and Communist progress bluntly warn that unless we do everything necessary to hold our lead, we could fall behind.

Amazing Strength of American Economy

The United States starts this year's economic competition from a position of massive strength — never equalled by any other nation in the entire history of the world.

Our amazing country with little more than six percent of the world's population and less than seven percent of its land area produces and consumes over one third of the world's goods and services.

Our standard of living is four times higher than at the beginning of the 20th century and seven times higher than the world's average today. In 1900, each American had working for him through machinery the force of two horsepower; today, more than ten horsepower.

Research and development—which did not figure much before 1920—is creating new forces, new products, new processes, new services, new industries and new jobs. The total research expenditure for the Nation right now is estimated up to $9 billion per year with Government paying half the cost.

The growth of this over-all investment since 1940 has been more than ninefold. This year, the Administration will recommend a stepped-up program for Government.

Let no American in a moment of ignorance or jitters underestimate the vast strength and gigantic potential of our industrial base. The total value of goods and services produced by the United States in 1956 approaches twice the total produced by the three next highest nations. Surely that fact alone ought to wipe out some of the recent inferiority complex which seems to have been developing in this country.

But a point to recognize is that Soviet production is nearly 50 percent larger than the combined output of Germany and Britain—Europe's pre-war leaders. It is second only to that of the United States. And Khrushchev not only boasts that he intends to close the gap, but has some figures which tend to prove the point.

Recently he stated: "We declare war upon you—excuse me for using such an expression—in the peaceful field of trade.

"We declare war. We will win over the United States. The threat to the United States is not the ICBM, but in the field of peaceful production. We are relentless in this and will prove the superiority of our system."

Communists Copy America's Industrial Methods

Let's never forget that the modern industrialization of the Kaiser's (and later of Hitler's) military alliance gave the dictators almost enough power to win both the first and second World Wars. Not until America's industrial pressure was felt did victory swing to the Allies.

Modern Communists learned a lesson from those two close races. They have adopted our keen interest in technology, copied our mass production and, like us, have placed great emphasis on heavy industry. Because the Kremlin controls the Russian people, it can concentrate swiftly on a single goal in a given time limit.

The Soviet rulers have many grounds beyond military and diplomatic requirements which impel their forced-draft industrialization. One little known reason is a setback in population growth from war losses such as battlefield casualties, excess civilian deaths and lower births. This amounts all together to more than 30 million.

Starting this year, the number of 16-year-olds entering the labor force will drop sharply. Hence, Moscow is looking more and more to advanced technology, mechanization and automation to make up the manpower gap.

We have clear evidence of Soviet proficiency in atom bombs, ballistic missiles and sputniks. We also observe plenty of signs of growing economic muscle.

Soviet Move to Strengthen Economy

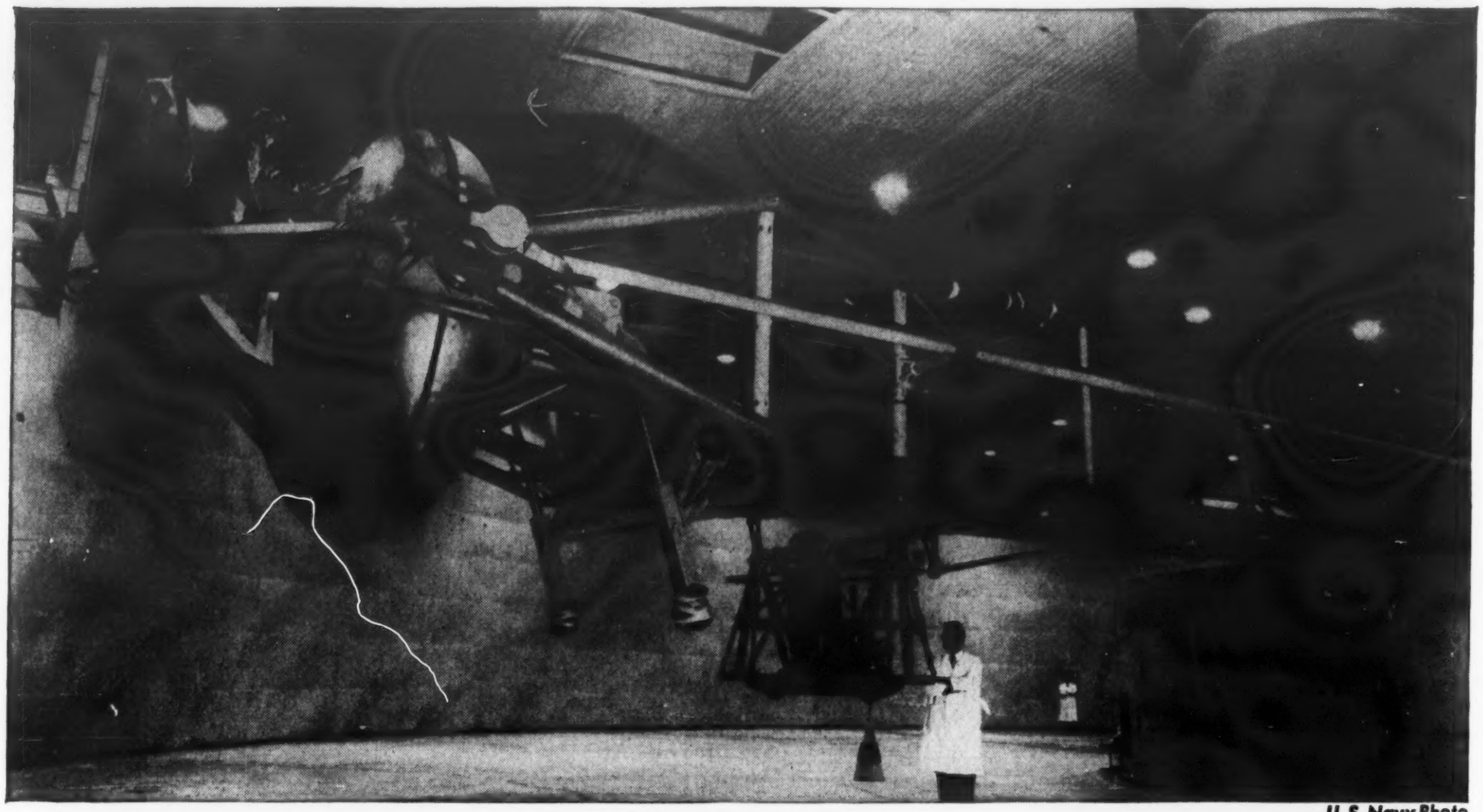
One new aspect of their latest economic drive is their recognition of the close relationship between the measurement sciences and technological development of industry.

A tremendous "crash" program is underway to beat us in that field.

(*Continued on page* 48)

on . . .

SCIENCE AND INDUSTRY



U.S. Navy Photo

The world's largest centrifuge for humans, at Johnsville NADC, is capable of producing 40 times the force of gravity. Flight surgeons and engineers can ride within the "cockpit" at the end of a 50 foot arm.

JOHNSVILLE NAVAL AIR DEVELOPMENT CENTER STREAMLINES RESEARCH VITAL TO DEFENSE

Located in historic Bucks County, just north of Philadelphia, the Johnsville NADC is carrying out a multitude of scientific tasks designed to keep our Navy's air arm second to none. Johnsville, the Navy's largest aeronautical research and developmental activity, developed the radar early-warning systems for planes now cruising above the oceans bordering the United States. Tremendous studies have been made at this center in airborne anti-submarine detection systems, and Johnsville scientists developed the first mock-up of a vertical take-off fighter.

The NADC Aeronautical Instruments Laboratory at Johnsville is engaged in development and evaluation for the Army-Navy Instrumentation Program, and was first to develop the automatic artificial stability control for rotary wing aircraft. Other NADC projects include high-speed low-level cameras . . . techniques for underwater launching of guided missiles . . . and radio controlled drone planes carrying bombs, used so effectively against the enemy in Korea.

This defense center covers over 750 acres, including a Naval Air Station which provides aircraft for scientists carrying out their experimental missions. There are eight laboratory groups at Johnsville, specializing in computation; aircraft armament; systems for drones, missiles and other special aircraft; aviation medicine; air warfare research; aeronautical instrumentation; aero electronics; and experimental photography, a field unto itself.

Many unusual facilities are available to Johnsville's scientific staff of over 2,200 people. In addition to equipment such as the giant centrifuge illustrated, the center has one of the world's largest analog computers – the TYPHOON – which can handle an infinite variety of engineering and aerodynamic problems. Johnsville has a fabrication shop capable of manufacturing anything from a delicate instrument to a complete aircraft. Huge cold chambers are available to test equipment for use under conditions such as those encountered in Operation Deepfreeze, currently underway in the Antarctic. Johnsville is cooperating closely in the Geophysical Year – as well as turning out a wide variety of scientific developments for BuAer, the fleet, and Navy contractors.

This is one of a series of ads on the technical activities of the Department of Defense.

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will the electronics industry come of age?

by Gen. Harold V. Gaskill • Vice-Pres. • Planning • Collins Radio Co.

IT IS RATHER RIDICULOUS to question the "coming of age" of the electronic industry in view of its tremendous growth and the importance of its accomplishments to date. But I believe it would be enlightening and instructive to indulge in a little critical self-analysis to see where we can expect our industry to add to its stature and to its maturity in the immediate future.

We need not look far to find great areas in which the modern world is placing on our industry demands which we have fallen far short of fulfilling. The sheer numbers in population assure continually increasing needs for advances in electronics from society and civilization. The U. S. population reached 170 million in February 1957. The Bureau of the Census predicts 206.9 million in the U. S. by 1975. UN estimate of world population in 1950 was 2406 million. In 1956 it was reported as 2700 million.

More and more of these people want and need to communicate with each other. Their economic and social interdependence, which is steadily increasing, creates new needs for communication. In communications of all kinds there is a seemingly unlimited urgent demand for more channels everywhere with the limit set only by cost, and in some cases by quality and accuracy. Without deprecating in any way the marvelous accomplishments of our present communication systems, it is obvious that if we can reduce cost and improve accuracy there is no visible limit to the amount of communication capability which the complex modern world will demand and absorb.

The blizzard of paper work is the task of a sizeable proportion of the population—the so-called "white collar" worker—still awaits an "office revolution" comparable to the industrial revolution which started with the introduction of power machinery and automatic processes in our factories. The benefits to be derived from electronic automation—the sort of thing we now call "data processing" and the like—will certainly be nearly as sweeping as those which have come from the change in the tools of production. Adequate control of production and distribution will have far-reaching effects. The key here again is *cost reduction*, and it is up to the electronics industry to find a way to bring the "magic brain" within the economic reach of the ordinary factory, office and store.

Our much vaunted "jet age" of aviation, having crossed the sonic barrier, is now blocked by a new traffic barrier. So far, electronics has not come forth with an adequate air traffic control system which will permit the full realization of the potentials of our sister industry. Much progress has been made, but if we are honest with ourselves, we can only say that so far we haven't come through with our part of the job.

Of course, in national defense the role of electronics embracing such things as guidance, control, navigation, detection and communication has increased in importance approaching that of nuclear weapons themselves. More on this in a minute, but I mention it now as one of our well known unfulfilled tasks.

I will leave it to those of you who are associated with the consumer goods fields to fill in the outline of jobs to be done in these areas. There are many other areas—I wish only to make the point that in spite of the spectacular accomplishments of electronics to date, we have much to do to keep pace with the demands of our world.

How can we grow into this man-sized job even more effectively than we have at present? It is helpful in attempting to answer this question to compare our industry with another which is older and surely more mature, the chemical industry. As an observer on the outside of the methods and policies of the chemical industry, here are some things from the management viewpoint which might help us.

First of all, let us compare what appears to be a typical attitude of the chemical industry's management toward pure and applied research with that of the electronics industry. Chemical manufacturing started with the ancient alchemists and apothecaries, and the development of the chemical industry over the years has been based upon an intimate working relationship with the basic sciences. Today the laboratory is such an integral part of the industry that it is accepted without much fanfare or publicity. Not only do the chemical plants maintain a high level of basic research, but they also have a close working relationship developed over the years with university laboratories, medical research laboratories, Government institutions, and similar organizations. The management of a progressive chemical company presumably has gone a long way toward solving the problem of how to work with the scientist and how to encourage him to make available the new knowledge which will lead to new kinds of production.

The same situation obtains in the electronics industry to a degree, but have we gone far enough? The electronics industry is popularly sup-

(*Continued on page* 14)

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TEAMWORK *and*.....

RESEARCH

by
Brig. Gen. H. F. Gregory, USAF
Commander, AF Office of
Scientific Research

NOT TOO MANY DECADES ago, as a boy in Mississippi, I would lie awake in bed at night and dream of flying airplanes. Later when I won my wings as a Second Lieutenant, this youthful fantasy became a strange but wonderful reality. In the years that have followed, however, I have learned that the airplane and the "airpower" of which it is a part is not just Air Force pilots, aircrews, or technicians; nor is it just radar nets, bases scattered throughout the world or complex machines and weapons—although these are important parts of it. Airpower is the whole vast complex of our Nation's air industry — basic scientific research, aeronautical development, aircraft manufacturing, communications and electronic systems, physics and nuclear physics, chemistry, solid-state physics, mathematics, commercial aviation and all the pieces which when fitted together make up airpower.

The Air Force Office of Scientific Research, an organization of the USAF Air Research and Development Command, is vitally interested in one piece of this complex—scientific research. Research in the basic sciences directed toward fundamental, theoretical or experimental investigation to increase man's knowledge and understanding of the natural world. Naturally, this research is orientated toward Air Force functional interests but, and I believe this is most important, the American defense structure is so complex and vast in scope of operation that any major scientific discovery is of interest not only to the Air Force but to all the Armed Services and the entire research and development community at large.

Speaking of research, I would like to say a few words about the AFOSR research program. The capability to carry out our research mission is represented by scientists working in some 250 laboratories throughout the free world, in universities, in industry, in foundations, and in Government agencies under approximately 650 research contracts awarded by our organization.

At this point, I would be remiss if I did not briefly mention some of the present-day accomplishments of investigators in the field of electronics and communications which are of considerable interest to the Air Force. For example, the recent discovery of the solid-state MASER (microwave amplification by stimulated emission of radiation) principle has provided us with the possibility of doubling the sensitivity of radar. In this regard, the use of components having noise figures equivalent to the order of 10 degrees absolute opens an entirely new field of thinking for the electronics engineer. We are most desirous of encouraging further investigation of MASER as fast as possible with a view toward exploitation of the obvious advantages and exploration of the new horizons that this principle has opened to us.

Transistors and Antennas

The transistors which have been developed permit a more efficient switching element for computers and the use of ferrites as non-reciprocal elements in antennas provides new concepts in the use of antennas and, as a gyrator, permits entirely new devices for handling signals in radar and communication equipment.

Space will not permit me to mention many of the contributions by a number of university investigators who have contracts with our organization in the same general field of research, so I shall emphasize only a few of the efforts which I believe tend to form a bridge between our respective interests.

One such area of effort involves circuit analysis and synthesis, particularly sampled data systems. These are receiving a great deal of research attention under AFOSR sponsorship both at Columbia University under Professors Ragazzini, Zadeh and others, and at the University of California under Professor Jury. Industry is making rapid use of sampled data techniques to optimize system performance where many complex operations take place. Since this is based on fairly rigorous mathematical analysis, it is much better than cut-and-try procedures which merely approximate the optimum results. I'm pleased to find numerous articles in recent publications arising out of this very useful area of research.

A second area of mutual interest that I want to mention is the generation and use of frequencies in the millimeter wave-length region. Considerable progress has been made both by universities and industry in the development of millimeter wave sources down to about 3 millimeters or a frequency of the order of 100,000 megacycles. These extremely high frequencies have almost optical properties which provide such important advantages as high gain, highly directional antennas of small size, and also large bandwidth. Since there is appreciable atmospheric attenuation at these high frequencies, short range "secure" communication and radar systems are obvious uses.

The present AFOSR effort is directed to lowering the wave length even more into the sub-millimeter region. Research on such sub-millimeter sources is being conducted for us at Ohio State University by Pro-

(*Continued on page* 13)

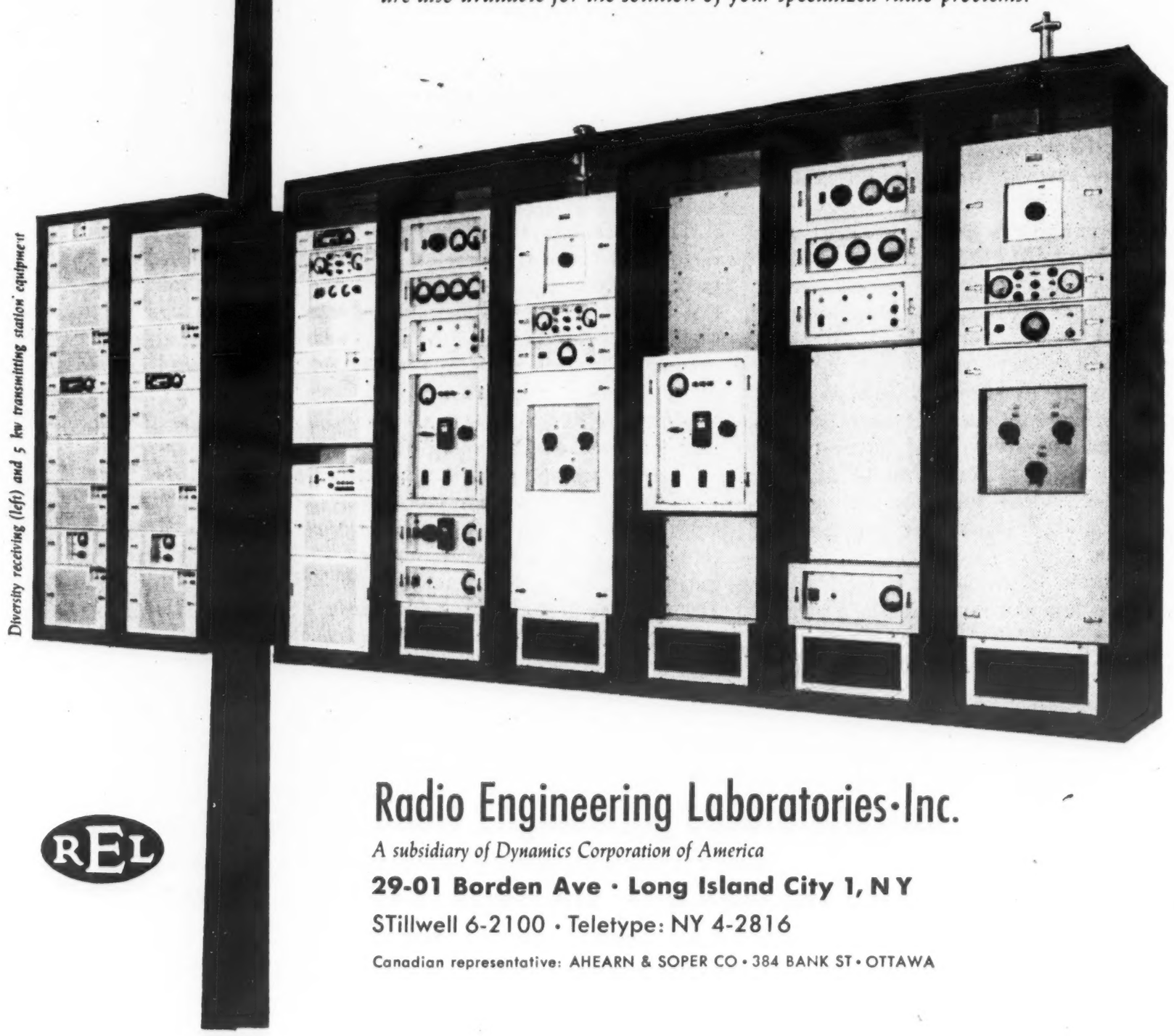
Weather links

Flying has been made safer and flights more regular by the weather information service which the Civil Aeronautics Administration is continually expanding and improving to keep pace with the growth of aviation.

An area of great meteorological importance is Alaska. Detailed observations there are of incalculable value in helping predict weather in much of the United States. To link its weather stations throughout Alaska, the CAA has commissioned REL to develop an ultra-reliable VHF communication system. It is to connect with White Alice, the giant military and civil Alaska communication system, whose tropo scatter radio equipment was also designed and manufactured by REL.

To meet—and exceed—the special requirements, REL has drawn upon its unparalleled experience in developing tropo scatter equipment. Improvements newly devised by REL for White Alice and other scatter systems are now being applied for the first time to line-of-sight communication.

The same imagination and resources which are setting new standards in this field are also available for the solution of your specialized radio problems.



Diversity receiving (left) and 5 kw transmitting station equipment

REL

Radio Engineering Laboratories·Inc.

A subsidiary of Dynamics Corporation of America

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Canadian representative: AHEARN & SOPER CO · 384 BANK ST · OTTAWA

Teamwork and Research

(*Continued from page* 11)

fessors Boone, Mueller and Thurston; at the University of Illinois by Professor Coleman, and at Oxford by Professor Motz. Associated with the generation problem is the problem of coupling and transmission which is being investigated by Professor Fellers at the University of South Carolina.

Low Frequency Propagation

Another area of interest is that of low frequency propagation, one example of which is the work on the so called "whistler" mode of propagation supported by AFOSR at Stanford University under Professor Helliwell. I believe its significance as a possible tool to probe into space beyond the ionosphere and throw new light on some very unusual transmission phenomena makes it worthy of mention. It appears that in this transmission mode, the signals are not reflected by the ionospheric layer in the usual way but travel thousands of miles out into space and back along lines of the earth's magnetic field. If this supposition proves to be correct, then the space beyond our atmosphere is not as empty as we thought since a certain minimum ionization density is required to support such propagation.

A further area of mutual interest somewhat related to the extraordinary propagation phenomena just mentioned is that of radio astronomy, especially studies of solar radiation in the microwave frequency spectrum. If you are wondering why the Air Force has an interest in solar phenomena, I need only point out that the sun's radiation is the chief cause of atmospheric as well as ionospheric disturbances which seriously affect radar and communications. Information is urgently needed on the basic causes of sunspots, flares, corona emission and solar magnetic fields. Associated with the sunspots are gigantic magnetic fields and violent solar flares which extend for millions of miles into space, disrupting radio communication and playing havoc with the earth's magnetism.

In order to obtain more precise data on these unusual solar events, AFOSR is supporting research by Professor Bracewell at Stanford University who is now completing an exceptionally large spectroheligraph which will provide new and more exact data on solar phenomena. Like the "whistler" propagation work, Professor Bracewell's efforts are also closely coordinated with the extensive solar readings being taken by IGY scientists throughout the world.

I could dwell on many more areas in which there is a common interest. I am tempted to emphasize meteor burst communication, new microwave devices and the very new amplifiers and oscillators which are based on molecular amplification or on quantum mechanical transitions. All of these are important to the Air Force and I am sure they are equally important to you—our contractors. As new trends develop and new discoveries are made by our scientists, Air Force research will go hand in hand with your efforts. Our common objective must be to re-enforce and strengthen our search for new knowledge and the technical application of this knowledge to our weapon systems. We must face this clearly from the standpoint of both the critical world situation and the stiffening competition from the Soviet Union.

A fundamental research program which embraces the scientific community of the Free World and one oriented toward Air Force functional interests provides a hard-core of scientists from universities and industry alike who are on the alert to maintain the Air Force's lead in our scientific position and who can, along with us, at the appropriate time, quickly recognize and exploit scientific discoveries toward new and significant military applications.

I believe one of the most important jobs to be done in research and development today is that of integrating research workers into a team with the common objective of insuring that our military forces are second to none in technological perfection. I do not wish, however, to underestimate, nor do I overlook, the importance of the peaceful non-military advances in industry, national economy and the sciences that will surely result from such team effort.

From a national viewpoint we must keep our eyes on the enemy at all times in order to know his intentions and we must keep our scientific minds active to surpass him in technical "know-how" and the understanding of natural law. This can only be accomplished through sound, dynamic, and effective programs in fundamental research and military intelligence.

In closing, let me say that my childhood dreams have been replaced by a vision of the Air Force of the future, one which is in the laboratories today and one which I sincerely believe will play a major part in providing the ultimate means for the maintenance of world peace.

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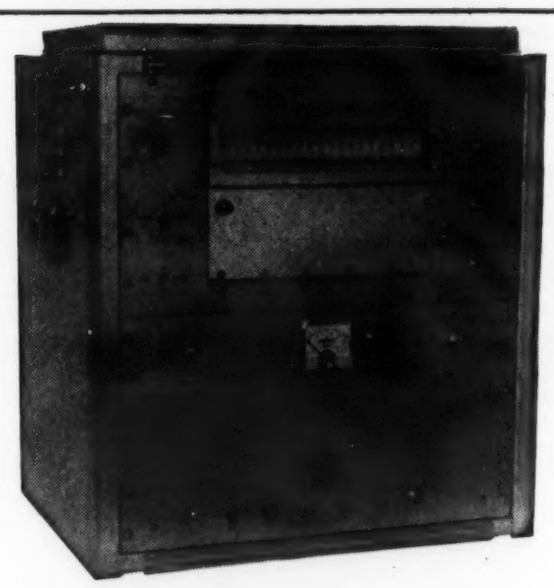

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Will the Electronics Industry Come of Age? (*Cont. from page 9*)

posed to epitomize the fruits of research. But actually, is not the overwhelming percentage of our so-called R & D devoted to the ingenious contrivance of new hardware, principally by rearranging our old building blocks, with little emphasis on the search for basically new building blocks and techniques? A striking example of a major step forward which was accomplished by resorting to the basic sciences is the transistor which is now being followed by a whole host of new solid-state devices. The example of transistor development should encourage us to dig deeply for basically new things and new knowledge at the same time that we continue our well developed facility for bringing out ingenious hardware. Part of our difficulty, I believe, is that it is so easy to contrive some new product merely by the use of a soldering iron that we become fascinated with the rearrangement of old building blocks and overlook the possibility of finding new ones.

We can also ask if we have the best working relationship with the university research worker. Has not electronics management been too preoccupied with the competition for recruiting graduates, possibly at the expense of supporting and expanding the contribution which can be made to useful basic knowledge in the university laboratory? It is my opinion that many chemical companies have worked out over the years a more fruitful relationship with universities than we have. Part of the problem, of course, results from the fact that many universities have accepted sponsorship for programs which are really more in the nature of engineering hardware than in the nature of research, simply because such sponsorship is easier to obtain. An industry can exert some leadership here since the engineering jobs should be done more effectively in industry than can they be done in the schools. But the schools need encouragement and tangible assistance from industry to realize their full potential in basic research.

The next point of comparison between the two industries is the extent of capital investment made to exploit a new product or processes. It is well known that many chemical industries spend tremendous sums of money to build elaborate plants to implement the results of their research in terms of quantity production at the lowest feasible cost. This is not alone the result of large scale demand or even because the big chemical companies are so well heeled that they can afford to make large capital investment. The important element is that management has seen fit to do such a fine job of research and development that they have the confidence and courage to venture a large investment on the validity of their R & D. Thus, it must be an attitude of mind which leads to long range thinking in research and willingness to trust the findings of the research worker.

Of course, we have similarities to this same situation in electronics. But have we gone far enough? After all, the basic production tool in the electronics plant is still the soldering iron. We talk of more effective production machines, but so far—except in the component plants—we haven't gone much farther than substituting the deep soldered printed board for hand soldering. Similarly, many of our designs are so ephemeral that we hesitate to use other than general purpose or temporary tooling. We are inclined to ascribe this reluctance to institute drastic changes in production equipment to the rapid progress of the art. In view of the big demands which are facing us for electronic products, perhaps in some

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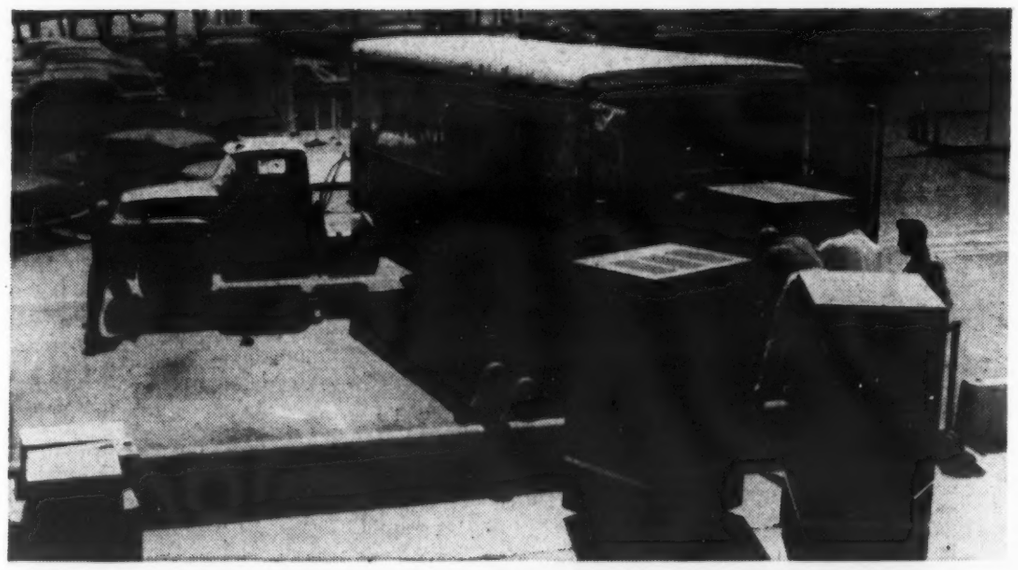
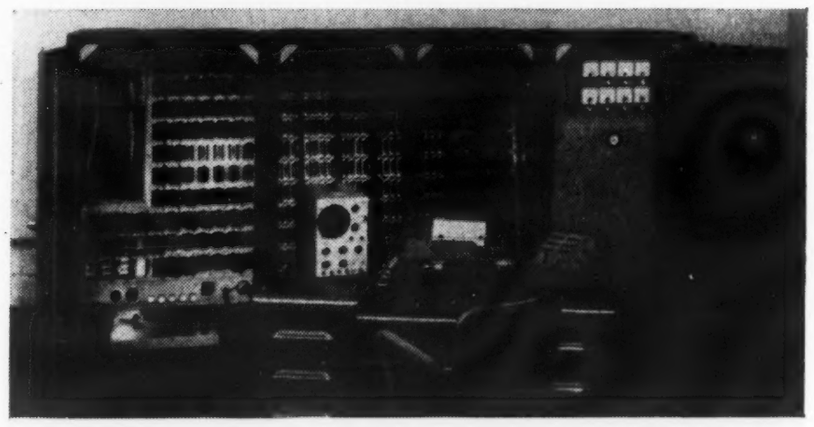
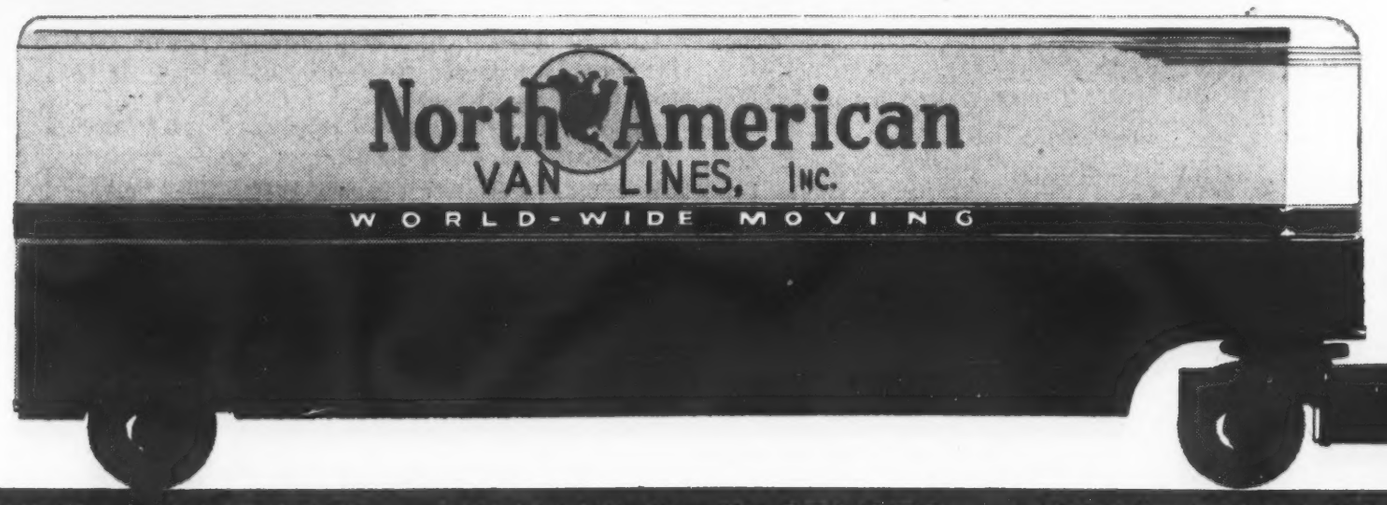




Left—Alwac, electronic digital computer, loads *uncrated* into padded van at manufacturer's West Coast plant.

Right—North American's fast, safe service—door-to-door—has customer's unit in operation ahead of schedule.



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instances we would do well to think farther ahead and progress by bigger jumps at less frequent intervals. Then we would be justified in calling for a larger capital investment than just tools for production in order that we might have a better and less costly product.

Still another difference exists between our industry and that of many others, including the chemical industry, in that a very large proportion of the R & D effort in other than consumer-goods areas has been devoted to Government sponsored military development. This has become so much the pattern that it may have affected adversely our ability for leadership up to the present time. No company in its right mind would undertake the development of the more exotic types of military electronics such as those having to do with detection, missile guidance, countermeasures, and similar developments, because of the heavy investment required and the uncertainty of recovering this investment through production. On the other hand, there are many types of military requirements which differ from civilian requirements in a very minor degree, as for example communication equipment. Here I believe it behooves industry to attempt to demonstrate to the military services that it is willing and capable of developing this communication equipment on its own initiative, certainly to a larger degree than it has in the past. To some extent, the military procurement agencies have resisted efforts in this direction. Probably, this resistance stems largely from habit formed during times past when military and civilian requirements were much more divergent. There is reason to believe that industry could demonstrate easily that much military R & D could be accomplished within the framework of unsponsored private enterprise and competition at lower cost and with an accelerated rate of development. By comparison, the chemical industry has had many significant developments stemming entirely from its own unsponsored research and development. It is true that the chemical industry has built and operated large Government owned plants for major military projects, but it does not appear that the industry has waited to be led by the hand. Our industry has a very real obligation for leadership in the solution of problems of defense. Just see what highly significant effects could be obtained with relatively small improvements in reliability and maintainability of electronic equipment. Sound planning of all of our research is essential. Sound planning is the first—though not the only—requirement for success in research. Planning of research must be a top management responsibility, and just here is precisely where appropriate and effective leadership can be exerted. Such leadership will attest to our maturity.

This critical self-analysis represents my thoughts about how and where we can manifest the evidences of coming of age. I suppose the clinician would say you are not only kind in permitting this self-criticism, but healthy as well. Because there is nothing fundamentally or insurmountably wrong when we can engage in self-criticism.

In my opinion, though I've indulged in criticism, our industry has shown a disposition to leadership and there are many evidences of responsibility. And these two characteristics are most important in enabling us to attain the maturity of coming of age. The future is assured, and the significant social contributions by electronics will be made. I'm glad to be a part of the electronics industry.

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BASIC RESEARCH

by Dr. Guy Suits, Vice President & Director of Research, General Electric Co.

★ ★ ★

SINCE THE APPEARANCE of the Sputniks, basic research has suddenly become a public issue. It is regarded as providing a kind of antidote for all sputniks, past or future, in a manner that is not entirely clear. Two important issues surrounding basic research appear to be: first, *what is it?* and second, *what does it have to do with national defense?*

What is basic research?

Most definitions try to imply a *motivation*—or lack of it—for performing the research. Thus it becomes easy to say that basic research is "looking for new scientific knowledge without knowing what it will be used for."

Actually, this is not a bad answer if you are talking about the way many good scientists visualize their work. Much of our technological progress is based on scientific discoveries by men who never visualized what the "practical result" of their work would be. Their motivation was simply an intense curiosity about nature.

Although the satisfaction of curiosity about the world in which we live provides a tremendous human drive for scientific progress, the sponsor or the supporter of the research — whether government or industry— should have a purpose which is expressed ultimately in terms of human welfare. In industrial research we seek new knowledge of nature as a foundation for new technology which will lead to new goods and services. We regard this activity as a very important source of future industrial progress and growth not only benefiting the sponsor but bringing benefits to people everywhere.

Since curiosity provides ample motivation for the scientist but is not a sufficient motive for the supporter of research, the question of "why you do it" tends only to confuse the definition of basic research. What is important, to the scientist and to his sponsor, is the search for new knowledge and understanding of nature.

Thus, in simplest terms: *basic research is the process of learning new scientific knowledge.*

What does basic research have to do with the national defense?

New industrial technology is becoming a progressively more important source of innovation in products, services and manufacturing methods. Since new or improved technology usually originates in new scientific facts which come from basic research, this activity is an important source of competition. Without it, business may fail or lose position.

A similar competitive drive explains the importance of basic research to the defense establishment. All of the modern weapons in the arsenal of defense depend upon technology, some of it exceedingly complex and all of it subject to rapid obsolescence as a result of new scientific discovery. The time is long since past when new weapons originated in the blacksmith shops. They will to an increasing extent originate in basic science research programs, and we must be certain that no political competitor forges ahead of us in research. To permit this to happen could be a fatal mistake.

The Five "Sputniks"

That this is a real possibility is indicated by the Sputniks — all five of them. I list five "Sputniks" because five very significant Soviet events have raised clear warning flags that this competitor is rapidly forging ahead, scientifically and technically. These events have been:

(1) the detection in 1949 of the first Soviet atomic bomb, much earlier than anyone predicted;

(2) the announcement in 1953 of their first hydrogen bomb;

(3) the gradual realization, around 1955, of the fact and its basic importance that tremendous programs of Soviet technical education and scientific research existed;

(4) the recent achievement of the first successful satellite;

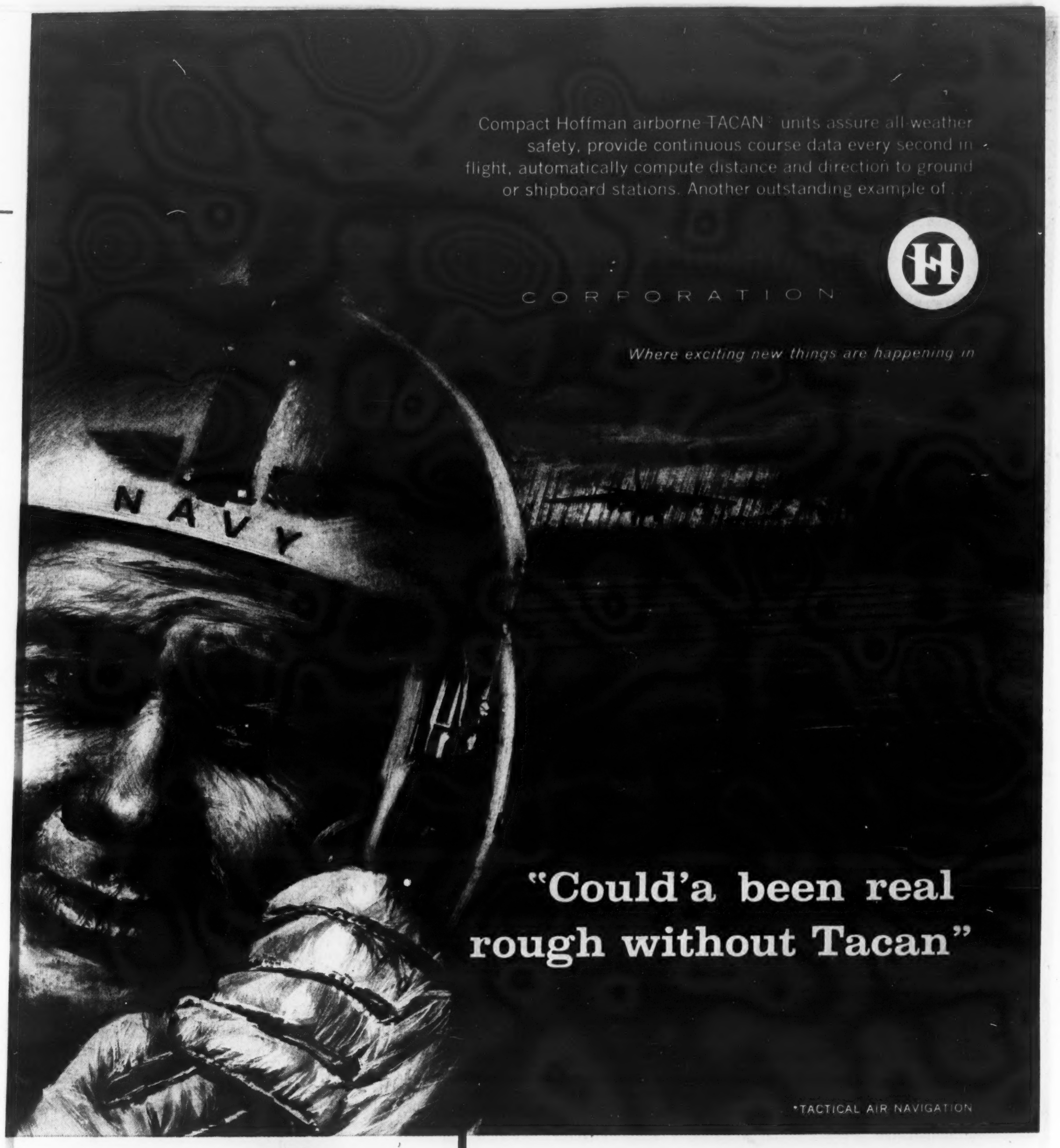
(5) the recent successful launching of a 1000-pound satellite into its orbit.

Events (4) and (5) I regard as flying blessings with silver linings because they have finally shocked public consciousness into a feeling of impending doom. Because of them we are now engaged in a critical examination and appraisal of our whole national posture on science and technology. To do so thoughtfully requires a study of not one but *all* of the aspects of our dilemma which in aggregate add up to the problem of national survival in a scientific age.

In Retrospect

We must start our inquiry far back in the educational system and carry it through the whole range of activities up to and including the final utilization of the results of new scientific progress. At almost every point in this chain of events, there are outstanding opportunities for improving the performance and efficiency of our effort. We do not, for example, except by accident, detect technical aptitudes in our young students. How many potential Langmuirs and Einsteins have been lost to science no one will ever know. If we did detect these aptitudes we wouldn't know what to do about them, for our technical subjects are taught with so much apology and so little inspiration that only the hardiest enthusiasts among our students survive the ordeal.

(*Continued on page* 30)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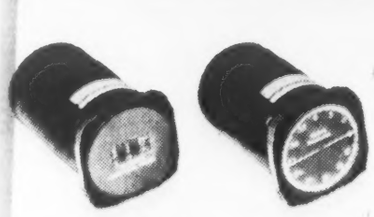

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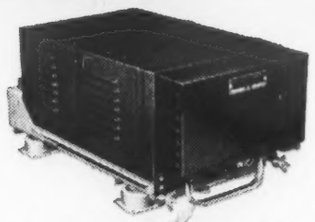

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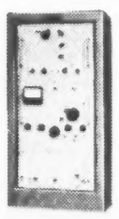

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TELEVISION IN THE SERVICE OF EDUCATION

by Cyril M. Braum
Joint Council
on
Educational Television

THE POTENTIAL USES of television in education were foreseen by many educators years ago and, during FCC hearings on television allocation matters, they requested that some TV channel assignments be reserved for noncommercial educational use (as FM channels had previously been reserved). When the FCC adopted new rules and a revised TV allocation plan in 1952, 242 assignments or approximately 12% of the total were reserved. One third of these were VHF and two thirds, UHF; the number has since been increased to 256, the VHF-UHF ratio remaining the same. This reservation policy of the FCC has been correctly called a parallel to the Morrill Act of 1859 which made available tracts of land in the public domain and led to the development of a nation-wide system of land-grant educational institutions.

Interest in building educational television (ETV) stations began promptly and the first, KUHT in Houston, Texas, went on the air in 1953. Despite the high cost of television stations, construction has gone steadily forward. January 1958 finds 30 ETV stations on the air, from Boston to San Francisco, from Seattle to Miami and Puerto Rico, serving areas with a total population of more than 50 million. Alabama uses a state-wide ETV network of three transmitters to reach approximately 80% of its population. By the end of 1958, about 40 ETV stations will be on the air. In several dozen other communities throughout the U.S., planning is well under way.

In many cases, ETV stations are of the community type, licensed to nonprofit corporations created especially for this purpose, including educational, cultural and civic organizations. In some instances, stations are licensed to individual universities and school systems, and usually other schools or community groups participate in station programming and operation. Sometimes, state agencies or television commissions are the licensees.

Financial support has come from many sources. It has been provided by state legislatures, institutions of higher learning, boards of education and municipal governments; assistance on a matching basis has been given by the Fund for Adult Education, an independent agency established by the Ford Foundation; equipment, funds and counsel have been provided by commercial broadcasters, and contributions have been given by business and by the public. Thousands of volunteers have assisted greatly in station planning, organization and operation.

All but six of the presently operating stations are on VHF channels, and the only ETV station that has ceased operation was a UHF station in Los Angeles—a seven VHF station area with no other UHF service. Most of the reserved VHF channels in large cities either are in use or will be in the near future. Many major cities, however, have only UHF channels available for educational broadcasting, and the present problems of UHF must be faced. Educational interests are active in the work of the Television Allocations Study Organization, looking toward a healthier UHF service for both educational and commercial TV. The UHF ETV stations now operating are generally in areas having no other UHF service and the circulation problem is difficult. Much of the programming of these stations consists of in-school teaching, with programming for the public increasing gradually with UHF conversion. In Cincinnati, for example, where station WCET alone is on UHF, this pattern is being followed. About 85% of the 150,000 students in the WCET viewing area attend the 250 schools that are UHF equipped, and the approximately 20,000 UHF sets now in the area indicate the increasing interest of the general public.

Programs being provided by ETV stations include telecourses and other informational material at the adult level, in-school instruction, children's programs and those directed toward adult leisure and civic participation. The range of program material is virtually without limit, and awards given for many programs are a tribute to their quality. Most popular categories in adult programming concern music, literature and philosophy, and science and industry. Much basic programming is provided for ETV stations by the Educational Television and Radio Center at Ann Arbor, Michigan. The Center contracts for the production of program material by ETV stations and others, providing programs on kinescopes and films and featuring great teachers and artistic performers who would not otherwise be available to local stations. Currently, the Center provides 7½ hours of programs per week, most of which are kinescopes produced by ETV stations.

A recent survey indicated that the proportion of live programming by ETV stations was 58%; kinescope material, 24%, and film, 18%. The average program schedule is over 30 hours per week, and at some of the older stations it is much more. The Pittsburgh station, WQED, broadcasts 83 hours per week and WQED has requested the assignment of a UHF channel in addition to its pres-

ent VHF channel. Both channels would be used to program classroom instruction throughout the school day. Presently the station sends seven programs daily to 350 classrooms in 58 school districts, together with 22 parochial and 2 private schools, in 7 counties in western Pennsylvania.

Closed circuit TV for instruction has received increasing attention. Well over 100 educational institutions are now using or experimenting with it. Studies made at many colleges and universities, covering a wide variety of subjects and courses and carefully compared with control groups, indicate that student achievement by TV teaching is almost invariably as good and is sometimes better than by conventional instruction. High schools and elementary schools are also exploring closed circuit TV and early reports also are favorable. By far the largest experiment in closed circuit TV is at Hagerstown, Maryland, where 12,000 students in 23 schools now receive instruction over closed circuit TV. Studio facilities provide for as many as six simultaneous programs transmitted on conventional TV channels over the coaxial cable. In the fall of 1958, all 48 schools in Washington County, with 18,000 students, will be included in the system. Manufacturers are supplying equipment for this project, the local telephone company is furnishing the cable facilities and the Ford Foundation's Fund for the Advancement of Education is giving financial support.

The Southern Regional Education Board, an agency formed by 16 states from Delaware to Texas for the purpose of making better use of colleges and universities by sharing resources for professional, technical and graduate education, is considering the establishment of a large microwave network. It would link 309 educational institutions of higher learning in the region, using six circuits over much of the proposed 10,400-mile network. Since such privately-owned microwave facilities are not now licensed, the SREB and other educational interests have petitioned the FCC to amend the rules.

Summing up, in five years ETV has become a well-established, significant part of the educational process. Administrators and teachers are turning to TV for improving instruction and for assistance in solving teaching problems and needs. Skepticism and doubt are disappearing. As so well expressed by Dr. W. R. G. Baker, "The use of television in education is controversial mainly to those who have never seen it in operation."

W. J. Baird

Editorial

February is a month of historical importance. Historically, it dates the announcement of "Explorer" being successfully placed in orbit; it bridges a gap from Washington's struggle for independence to Lincoln's desire for unified Government. Traditionally, it should cement our past memories with our aims and our objectives of the present. The patriotism which inspired our people, during the days of the American Revolution, remains a symbol for tomorrow's freedom. Once again, the liberty bell rings out for a unity of effort and a sound course of direction if all free nations under God are to enjoy the peace which we so much desire. To preserve this peace, we must strengthen our spiritual thinking, utilize our political wisdom wisely, and strive for the establishment of an economic freedom of choice for the individual. After all, economic freedom of choice is the basic foundation of our free enterprise system. It is a system founded on democratic principles as we recognize them, instead of a policy of dictatorial compulsion. In these days when international propaganda causes no end of concern and brings about entirely too much self-imposed frustration, we can consider ourselves quite privileged to enjoy, among other freedoms, the right of self-expression. In exercising this Constitutional right, we are prone on many occasions to criticize unjustly. Now is the time to speak out constructively for it is our responsibility to assist our Governmental officials to the best of our ability so that they may resolve the weighty problems which confront them and which are inherent in a position of world leadership. Only in this way can we solve tomorrow's problems and reach a meaningful conclusion. The blueprints of our present position in world affairs must be established today if we are to enjoy the heritage of peace which has been handed down to us. The proclamations of an earlier era which were indelibly imprinted on the minds of men by the liberty bells must be heard again. Our aims and objectives—where we stand, where we are going—should be recorded before the world. Any deviation from our policy and any interference with it from aggressor nations is a matter which should be laid before the World Court. In this way, responsibilities for interference with the preservation of peace can be established. It is only sensible to think that no one wants to endure the devastations which would accompany another world war. Yet the advancements being made by aggressor nations in the fields of science and education, in the infiltration of underdeveloped countries, and in the suppression of people through propaganda devices add up to victories which could very well lead to a degree of defeat for western civilization. To overcome this trend, consideration must be given to the intensification of our efforts in the field of psychological warfare. The time for complacency has long since passed if we Americans are to help ourselves as well as other nations in maintaining the peace. We must be prepared to make reasonable sacrifices. By so doing, we can ring the bell of liberty for freedom and enduring peace. In working for the economic freedom of choice for the individual, let us also recall the words of George Washington when he said, "To be prepared for war is one of the most effectual means of preserving peace."

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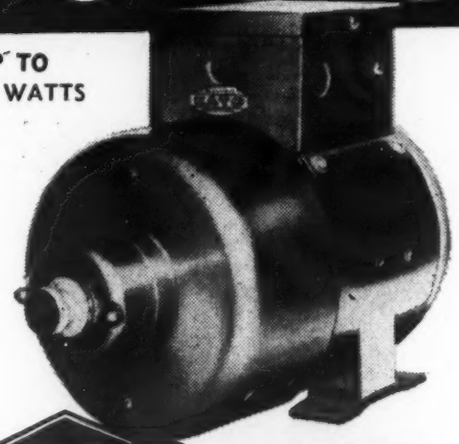

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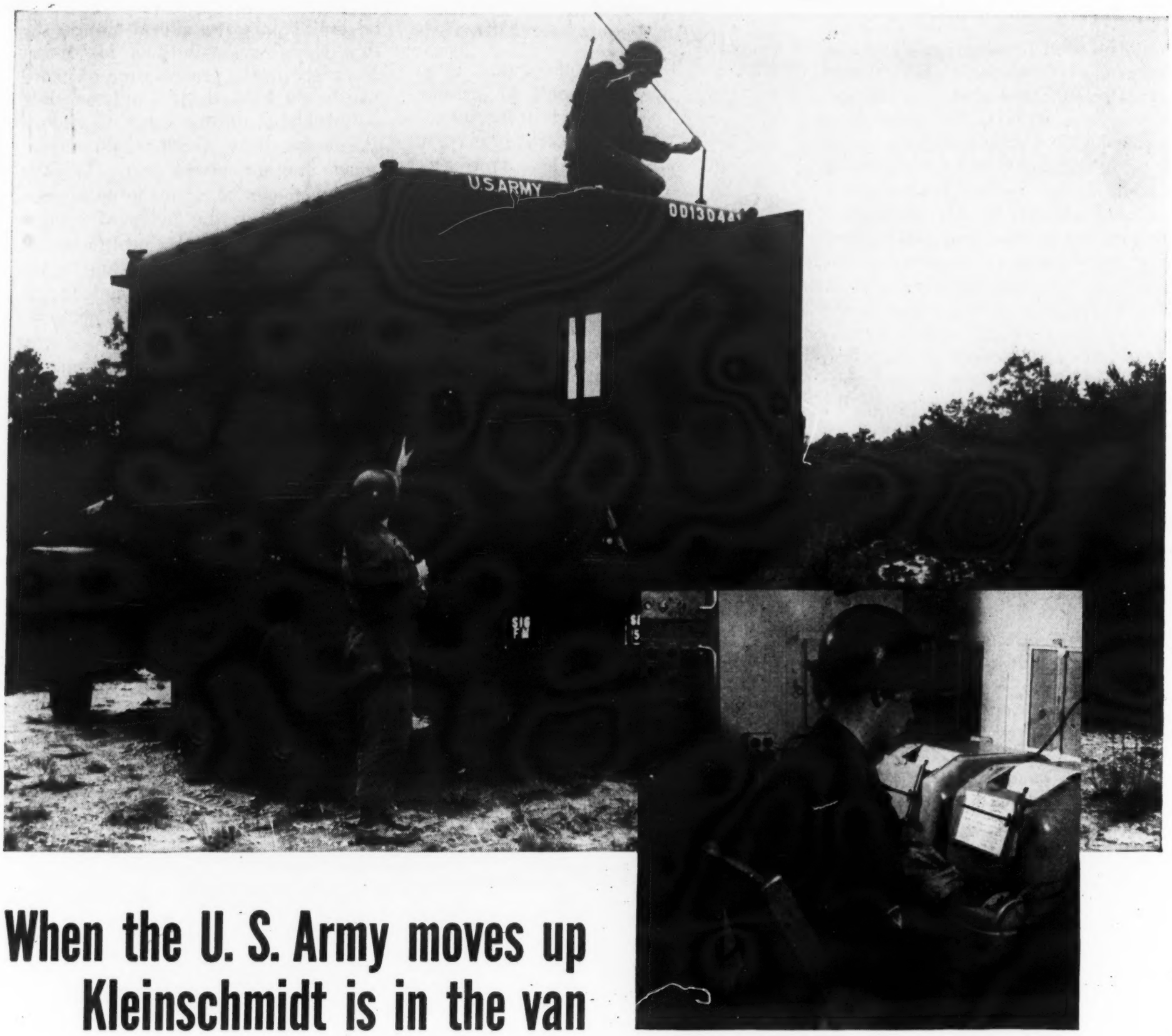


When the U. S. Army moves up Kleinschmidt is in the van

Kleinschmidt page printers and reperforator teletypewriters receive and transmit teleprinted communications wherever a truck can roll.

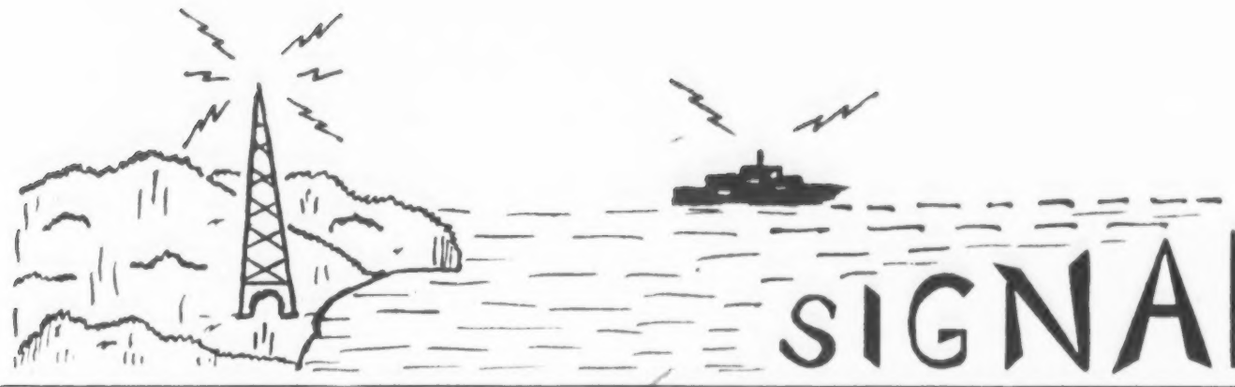
As division headquarters advances in the field, it is imperative that communications with outlying units be maintained without interruption. Kleinschmidt teletypewriters and related equipment, installed in a U. S. Army cargo truck and transmitting by radio, provide a message center that meets every demand of mobility and dependable two-way communications. These Kleinschmidt units, developed in cooperation with the U. S. Army Signal Corps, furnish sender and recipient with an identical teleprinted original, eliminating misinterpretation and speeding the required action.

Research and development of equipment for transmitting and receiving printed communications has been a continuing project at Kleinschmidt for almost 60 years. This unparalleled store of experience, now joined with that of Smith-Corona Inc, holds promise of immeasurable new advances in electronic communications.

KLEINSCHMIDT LABORATORIES, INC.

PIONEER IN TELEPRINTED COMMUNICATIONS EQUIPMENT

A SUBSIDIARY OF SMITH-CORONA INC • DEERFIELD, ILLINOIS



SIGNAL·GRAM

— GOVERNMENT —

GOVERNMENT TESTS NEW MATERIALS WITH CONFISCATED GEM The National Bureau of Standards is using a 7½ carat "flawless" emerald-cut diamond taken from a smuggler for testing space age materials. A minute hole drilled through the costly jewel makes an ideal chamber for testing materials under great heat and stress at pressures as great as 450,000 pounds to the square inch. The Bureau said that the diamond creates conditions "that simulate the extraordinary heat and pressure that attend an atomic explosion or launching of a guided missile."

FIRST PAY-TV APPLICATION FILED AT FCC The applicant, Philadelphia Broadcasting Co., Inc., operator of UHF station WSES, Philadelphia, plans to use the system developed by Skiatron Electronics & TV Co. Under this system, non-subscribers would receive the same events on their TV sets as subscribers, but the former would only get distorted reception. Subscribers would have a card "key," used for billing purposes, to decode the distortion. The charge for home services would be $30 annually for basic sporting events and $1 for each special program—all commercial-free telecasts. No final FCC action will be taken on any applications until March 1.

TRANSFER OF ANCHORAGE COMMUNICATION FACILITIES Management and operation of the Anchorage communication facilities of the Army's world-wide communication system has been transferred to the Commanding General, United States Army Alaska, from the Commander, U. S. Army Alaska Communications System. This transfer is in accordance with Department of the Army policy to place strategic communications under the control of the appropriate Army commander. On its completion, the primary mission of the U. S. Army Alaska Communication System will be to provide public offering type communications.

DEFENSE AND COMMERCE DEPARTMENTS' NEW AGREEMENT The Deputy Secretary of Defense Donald A. Quarles and Secretary of Commerce Sinclair Weeks, signed an agreement in January relating to the joint use of certain facilities by the two Departments. While it is clear, that effective air traffic control and air defense systems must each normally maintain their separate identities, individual functional integrity and separate management, it is becoming increasingly clear that here are certain basic similarities in the processes essential to an effective operations of both systems. "The objective of the agreement is avoidance of duplicating facilities, equipment, and overlapping functions; increased capability of each function, and an air traffic control system functionally compatible with the Nation's defense facilities in peace and war."

CONTRACTS: ARMY: Western Electric Co., additional services and materials to continue the study of the entire military communication problem, $320,000; General Electric Co., digital computation facility operation, $1,118,084; Cornell Aeronautical Lab., development of combat surveillance methods, $1,500,000. NAVY: Westinghouse Electric Corp., reactor compartment components for the nuclear-powered aircraft carrier (CVAN), $46,050,000; Lockheed Missile Systems Division, POLARIS Development Facility, $3,000,000; Motorola, Inc., microwave radar relay terminal system, $306,602. AIR FORCE: Hughes Aircraft Co., advanced versions of FALCON guided missile, $19,278,275; Crosley Div., Avco Mfg. Corp., fire control systems, $1,000,000; Amphenol Electronics Corp., miniaturized multi-contact connectors, $211,368. OTHER: CAA: Collins Radio Company, microwave link installations to be used in a long-range radar program, $3,302,947; Texas Instruments, Inc., 14 airport surveillance radar systems, $4,691,000.

— INDUSTRY —

WORLD'S FIRST TRULY PORTABLE TV SET A fully transistorized and battery operated TV set has been introduced by Motorola, Inc. The set, a full 14-inch over-all diagonal model, consumes only 12 watts of power per hour, in contrast to the minimum of 105 watts consumed by present-day sets, and employs 31 Motorola-developed transistors driven by two nickel-cadmium batteries. Estimates at this time indicate that such a set could be marketed at a practical price around 1960.

JOINT EFFORT ON DATA PROCESSING MACHINE TRANSISTORS Texas Instruments, Incorporated, has signed an agreement with International Business Machines Corporation under which both companies will work together in the area of transistors for data processing machines. The agreement is expected to expedite progress in the areas of interest of both companies through the exchange of technical information pertaining to transistors. Each company will protect the confidential nature of the information exchanged between them.

READING HANDWRITTEN NUMERALS An experimental device the size of a portable typewriter that can read handwritten numerals or identify numerals as they are being written has been demonstrated by Bell Telephone Laboratories. A writing surface is provided on which there are 2 guide dots, one above the other, as reference points, with seven sensitized lines extending radially from these 2 dots. Numerals are recognized by the machine, depending on which lines are crossed. The inventor, Tom L. Dimond of the Systems Engineering Department, said that with some modifications the equipment could also be used to read handwritten letters.

X-RAYS AMONG LATEST POLICE IDENTIFICATION TECHNIQUES Cigarettes found at the scene of a crime can be identified and can lead to a criminal, not only by Sherlock Holmes' time-tested brand-identification method, but by determining paper characteristics through "soft" x-ray analysis. This was one of the techniques revealed to law enforcement officers studying latest photographic methods of crime detection at a seminar held at Eastman Kodak Company. The seminar covered crime analysis information gathered in preceeding months in such rapidly developing fields as photomicrography, radiological identification, and infra-red photography.

— GENERAL —

SCIENCE ATTACHÉS The U. S. soon may send as many as 12 science diplomats to embassies around the world to promote the flow of scientific information. The State Department said the program would be revived with a $200,000 appropriation under President Eisenhower's proposed new budget. The science attaches would go to London, Paris, Bonn, Stockholm and Tokyo.

EDUCATION TV BILL A bill proposing a $48 million Federal program to stimulate educational television was introduced in January by Rep. Hale Boggs (D.,La.) and was referred to the House Education Committee. This bill (H.R. 9634) would authorize maximum $1-million grants to each State for purchase and installation of TV equipment for public schools and colleges and adult training programs.

FREE COLOR FILMS AVAILABLE: (1) "The 500 Mile Adventure" is the title of a 30-minute motion picture film of the 1957 Memorial Day auto race at Indianapolis with a two-minute portion of the film illustrating the use of RCA-developed micro-miniature radio receivers. Request on letterhead to Advertising Manager Communications Products, Radio Corporation of America, Building 15-1, Camden, New Jersey. (2) "Beyond the Shadow of a Doubt" is a 16 mm. movie covering the operation of optical inspection and measuring machines with J & L Optical Comparators. This 31-minute film is especially valuable to those engaged in the field of inspection, quality control, methods, etc. Request from the Advertising Department of Jones & Lamson Machine Co., Springfield, Vermont. (3) "Energetically Yours" traces the history of man's unending search for new sources of energy, from the discovery of fire to the unleashing of the atom. Requests for this 13-minute superb cartoon should be directed to: Standard Oil Company (New Jersey), Room 1610, 30 Rockefeller Plaza, New York 20, New York. (4) "Heart of Instrumentation" reveals a complete history of early galvanometers and oscillographs. Address requests for this 25-minute dramatic documentary film to Paul Gregg, Advertising Director, Midwestern Instruments, Inc., P. O. Box 7186, Tulsa, Oklahoma.

OUTSTANDING EVENTS:

SYMPOSIUM ON TRANSISTORS AND SOLID-STATE CIRCUITS, February 20-21, University of Pennsylvania, Philadelphia, sponsored by IRE, AIEE, U. of Penn.

IRE NATIONAL CONVENTION, March 24-27, Waldorf-Astoria Hotel and New York Coliseum in New York City. Two special symposia on "Electronics in Space" and "Electronic Systems in Industry," will be presented Tuesday evening, March 25.

FOURTH ANNUAL AMATEUR RADIO TELETYPE DINNER, Monday, March 24, during the IRE show in N.Y. Guest of honor will be Bruce H. Rowlings, ALW1B, from New Zealand. Reservations must be made in advance ($7.), from Clayton Cool, W2EBZ, Editor, ARTS Bulletin, 443 West 47 Street, New York 36, New York.

SINGLE SIDEBAND AMATEUR RADIO ASSOCIATION ANNUAL DINNER, Tuesday, March 25, Hotel New Yorker. Last call for ticket reservations ($7.50) from Association's headquarters at 261 Madison Avenue, New York 16, New York.

A bird in hand...

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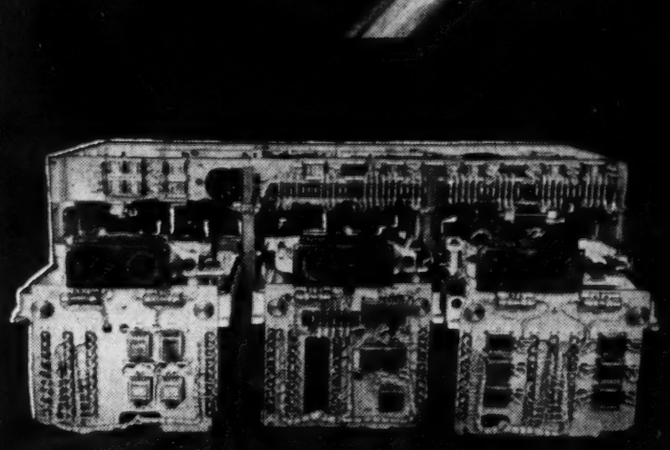

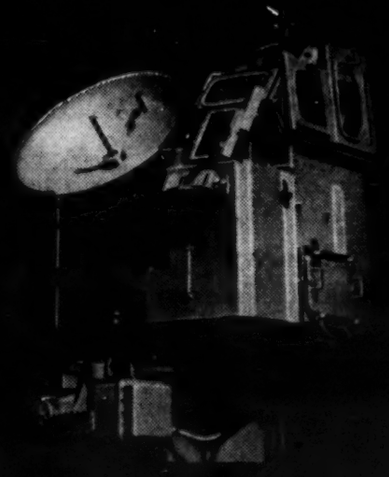

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MISSILE MASTER

An Electronic Air Defense Control System

by T. E. Gootée
Office of Technical Liaison
Office of the Chief Signal Officer

Display console of the first Missile Master. Seated at console: Honorable William M. Brucker, Secretary of the Army. Others (l to r): Maj. Gen. James D. O'Connell, Chief Signal Officer, USA; Lt. Gen. Charles E. Hart, Comdr., U. S. Army Air Defense Command; Mr. George M. Bunker, President, The Martin Co.

THE NATION'S FIRST FULLY OPERATIONAL electronic air defense control system—the Army Missile Master—is now continuously guarding the Baltimore-Washington Government-industry complex against hostile air attack. A key installation of the Army Air Defense Command, the Missile Master is a complete electronic system for control and coordination of Nike and other Army guided missiles in defense of critical areas.

After more than a decade of exhaustive research, development, and experimental testing by the Army Signal Corps, jointly with The Martin Company, the first Missile Master was formally placed in operation early last December by Secretary of the Army Wilber M. Brucker at Fort George G. Meade, Maryland.

A similar system is to be installed next in the New York area, and subsequently in the vicinity of strategic, industrial and population centers throughout the Nation.

"Employment of the Missile Master," stated Secretary Brucker, "will significantly strengthen Army antiaircraft defenses around major cities and key defense areas in the United States. By coordinating the fires of all antiaircraft weapons in any engagement with numerous enemy planes during a simultaneous attack, the Missile Master vastly increases the kill potentialities of our antiaircraft missile organizations. When we consider the potentialities of the Missile Master coupled with the increasing capabilities of the Nike, Hawk, and other guided missiles, it is evident that the Army is providing the Nation with a realistic and encouragingly capable air defense."

Age of Speed

With the advent of high-speed aircraft and the development of Nike, Hawk, and other advanced missiles of the Army, there is a critical requirement for a rapid, automatic system which collects and coordinates data on all air targets and which relays tactical decisions on missile strikes made by the defense commander and by weapons battery commanders to all other battery commanders in the area.

This is done instantaneously by Missile Master, which is the first integrated system for tying together all elements of antiaircraft missile defense from target detection to target destruction.

The system collects data on the location of all aircraft and their identity, and presents this information on electronic displays somewhat like TV picture tubes at the Missile Master and at sites of missile firing batteries. Any antiaircraft battery action in the area is also reflected instantly on these electronic displays for information or for related action by battery commanders.

In this way, each Nike or Hawk battery receives a continuous flow of fresh data on all aircraft within the defense area, and on the activities of other batteries as well. Each battery commander is provided with all the information needed to enable him to make a proper selection of a target.

Controlling and coordinating the fire of all Army antiaircraft missile batteries in an area assures their maximum effectiveness. Targets can be selected economically, with control of each Army missile retained by the local battery commander. In the event of hostile attack, preselected targets are assigned for destruction by Missile Master to individual Nike, Hawk, or other Army missile batteries.

System Operation

Basic technical elements of the Missile Master include data-gathering radar apparatus, automatic data processing and display equipment, and an automatic data communications network—linking the Missile Master with all missile batteries in a defense area.

The Missile Master, proper, is housed in a large, permanent building. Focal point is the Operations Center within this building where Army personnel at display consoles have a continuous view of the air situation in the area plus other specialized information including activities of the various missile batteries under their jurisdiction.

Adjacent to this building, surveillance and height-finding radar equipment on towers provide independent search and surveillance facilities. This is the principal source of raw data on aircraft and other air targets in the defense area. Data is also obtained from radar sets located at various sites of the antiaircraft batteries. Long-range target data may be provided by the Air Force SAGE, when that system becomes operational. When SAGE data is unavailable or incomplete, the Missile Master obtains data from its local surveillance radar equipment.

In all cases, collected raw data on targets is stored electronically and distributed to all display consoles in

the Operations Center of Missile Master and at the various batteries.

Key personnel of the Missile Master include: the tracking operators who monitor early warning data entering the system; tactical monitors who evaluate the progress of an engagement and assign specific targets to batteries; the "friendly protector" who insures that missile batteries do not fire on known friendly aircraft, and area defense commanders who supervise operations of the Missile Master.

Each operator has some type of display console featuring a TV-like picture tube. Target data appearing on the consoles of tracking operators are displayed with distinctively shaped markers to indicate different types and categories of targets. Tactical monitors have special displays which, by means of numbers and symbols, give all pertinent data on targets and on battery actions. Electronic switches permit controllers to view general or particular marker data on their own display consoles at any given moment.

Target Information

Target position data first enters the tracking sub-system of Missile Master and is displayed on the consoles of tracking operators. This data consists of position, identity, and velocity of a target—the size of the target and the priority of the target in cases where a priority has been assigned. This collective target information is distributed instantly to all display consoles in the Operations Center and at the missile batteries.

Tactical monitors normally watch the air situation and the target selections by individual batteries. But they can intervene to assign targets to specific batteries to assure quick engagement, or to terminate engagements to avoid duplication of effort.

During engagement of targets, the "friendly protector" watches the position of all known friendly aircraft and compares this information with the engagement data returned from battery commanders. At any time, this operator can halt any individual battery engagement of a friendly aircraft.

With the approach of hostile targets, identity and other data are collected and displayed on various consoles in the Operations Center and at the missile batteries. Tracking operators track and identify all targets of interest to the defense area. The tactical controllers monitor the progress of an engagement, as hostile targets approach within range of Nike, Hawk or other Army missile batteries, to insure that targets are engaged effectively.

At each missile battery, target data from the Missile Master is superimposed on the normal radar display. This provides the battery commander with information on targets to help him make an advantageous selection. Also shown are targets being engaged by other batteries of the area defense system.

Through data provided by Missile Master, a battery commander is able to select or receive target assignments without conflicting with or duplicating the actions of other missile batteries.

Development and Production

The first Missile Master, now in operation at Fort George G. Meade in Maryland, is the forerunner of similar installations for the Army Air Defense Command.

Research, design, development and testing was accomplished jointly by the Army Signal Corps and The Martin Company, the prime contractor, aided by the Airborne Instruments Laboratory, the American Machine and Foundry Company, the General Electric Company and other subcontractors.

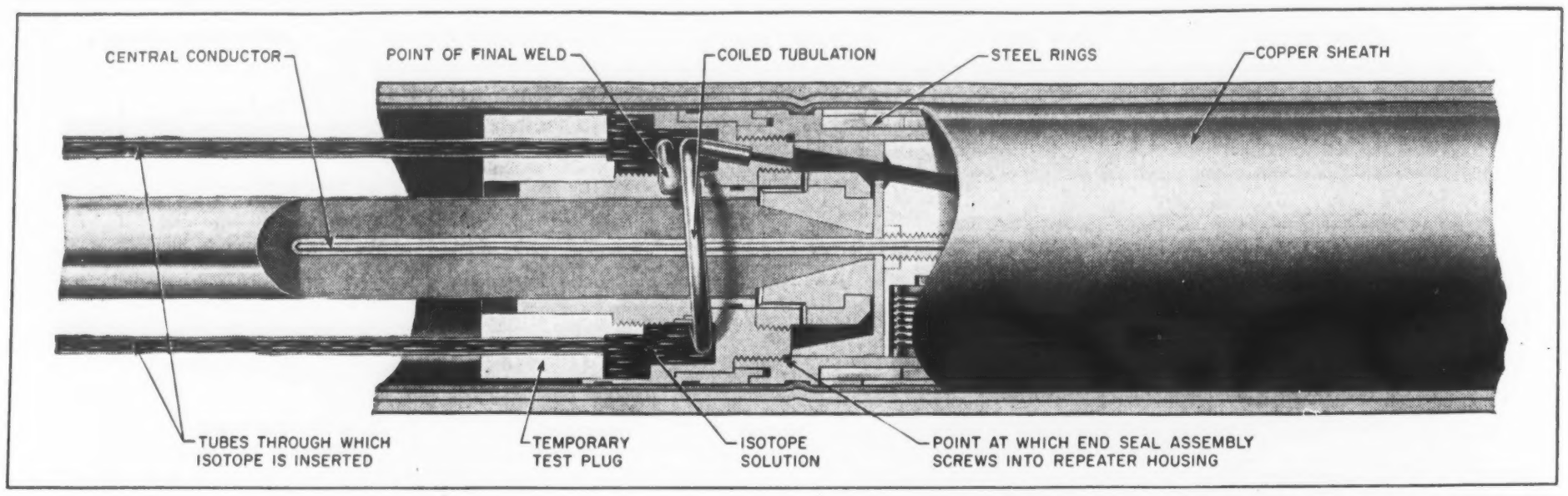
A complete installation of the Missile Master, such as now at Fort George G. Meade, costs in the neighborhood of ten million dollars. This and future systems are products of The Martin Company of Orlando, Florida.

Principal contributor to the design and construction of the Missile Master is the Airborne Instruments Laboratory of Mineola, New York, which has been actively engaged for the past nine years in research and development of radar tracking and display systems for the Army Signal Corps. The radar tracking and display subsystem of the Missile Master contains over 3000 vacuum tubes and relays. Eight radar display consoles permit the entry and tracking operators to detect hostile aircraft, establish tracks on these aircraft and monitor these tracks. Associated equipment contains memory circuits for storing the position, velocity, and height of targets and computing circuits for predicting future positions of these targets.

Tactical display equipment used in the Missile Master was developed and produced by the American Machine and Foundry Company of New York. Operating in conjunction with a central data processing system which accepts position information on targets, the equipment presents a map-like display of the air situation for tactical control operators for analysis and evaluation. A continuous picture of the positions of all aircraft in the defense area, together with significant auxiliary data pertinent to each target, are displayed on a cathode ray

(*Continued on page* 30)

Left: Tracking and monitoring consoles being operated by members of the 35th Antiaircraft Artillery Brigade. ***Right:*** The operator at the "friendly protector" console insures that known friendly aircraft in the defense area are not fired upon by Nike missile batteries.



END SEAL AREA OF TRANSATLANTIC CABLE REPEATER

Radioisotopes used in unique test of repeaters for transatlantic telephone cables

Flexible repeaters (voice amplifiers) for the new transoceanic telephone cables are expected to withstand ocean-bottom pressures of up to 6,000 psi for many years without developing leaks. At Western Electric's specially designed shop in Hillside, N. J., where the 36-channel carrier repeaters are made, engineers literally build perfection into the product, then enclose it in steel rings and a tube-like copper sheath. Before the completed repeaters are spliced to connecting cable links, they have to be sealed positively against the entry of sea water. This involves a series of welding and brazing operations.

But after the final point of welding and brazing, when there is no longer any means of access to the interior of the repeater unit, how could the engineers really be sure that the repeater would not leak under pressure at 2,300 fathoms?

The answer to this question is embodied in one of the most unusual of the many new and intricate testing procedures developed around the manufacture of the precision repeaters. It utilizes a solution of radioisotope "cesium 134." Here is how the test is conducted:

After the last of the series of welding and brazing closure operations, the ends of the copper repeater housing are filled with a solution of the isotope which is held against the seal by means of a temporary test plug fixture. The repeater is then placed in a test cylinder and hydraulic pressure of 7,500 psi is applied and transmitted to the isotopic solution. After 60 hours under this pressure, the radioactive solution is drained off, the repeater is washed and finally examined by means of a Geiger counter. If the Geiger count reveals that any of the isotope penetrated the end seal area, the repeater is rejected.

Geiger Counter is used to determine that no radioisotopes have penetrated into the interior of the repeater unit.

In practice, of course, the test is far more involved. For example, the washing of the seal calls for 60 different operations, each precisely timed. Also, to make certain that the production people know exactly what to do and when to do it, instructions recorded on magnetic tape by a Western Electric engineer are played back to operators over a loud speaker.

The perfection of this unusual testing technique is another example of the wide-ranging engineering activity at Western Electric . . . where engineers constantly search out and adapt the latest advances of science. It is an example, as well, of the exacting standards that govern the manufacture of Bell telephone equipment — an important factor in the dependability of the telephone service provided by Bell System operating telephone companies.

Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

REPEATER

TEN RECOMMENDATIONS TO MEET A CHALLENGE

General Sarnoff's recent comments before the Senate Preparedness Subcommittee are significantly important as to warrant publication for review by the readers of SIGNAL.

by David Sarnoff

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I appear before you today in response to a request from your Chairman. The critical area which your group is studying deserves the concern and attention of all our citizens.

To conserve the time of your Committee, I should like, with the permission of the Chairman, to come at once to the recommendations I respectfully submit for your consideration.

The Rockefeller Report

The first of a series of reports by the Special Studies Project of the Rockefeller Brothers Fund, which was released last week, dealt in considerable detail with the military aspects of United States security. While not a member of Panel Two which drafted this report, I am a member of the over-all committee which approved it. I subscribe to its basic principles and recommendations.

The Foreword by the over-all committee contains the following statement:

> "We have considered the draft of this report at various stages of preparation and we have gone over the final draft in full committee. Not every member of our group necessarily endorses every detail, but we have approved its substance, and we strongly urge implementation of its recommendations."

Section VI of this report, which deals with "Defense Organization" and recommends certain changes in the present setup, already has stimulated considerable discussion. Obviously, this is a debatable subject upon which well-intentioned men, inside and outside the military services, hold different views.

Having worked in both industry and Government, I have learned through many years of experience that the officers and the men and women of our defense establishment are a patriotic and dedicated group of people whose primary interest is the security of our Nation.

Unified Functional Commands

In recommending a principal military adviser to the President and the Secretary of Defense, the committee considered that the basic need in the Defense Department is to bring the roles and missions of the Services into closer alignment with the tasks which have to be performed. This need has been accentuated by the recent scientific and technological developments which have brought about revolutionary changes in military strategy and weapons. The proposal of unified functional commands seemed to the committee to be the best solution it could suggest for this problem.

Another objective is to free those charged with strategic planning from their present dual roles and to relieve them from the pressures of their separate Military Services. The committee felt that this could be best accomplished by establishing a single service for general officers above the grade of Brigadier General or its equivalent and by placing the Chairman of the Joint Chiefs of Staff in charge of strategic planning.

It may be pertinent to recall that the Joint Congressional Committee which investigated the Pearl Harbor attack and made its report to the Congress on July 16, 1946, proposed as its first and basic principle that unity of command was imperative at all outlying sectors.

Considering the shrinkage of the world caused by modern science since that report was written, it would seem that the principle of unity of command is even more valid today—for no longer are there any outlying sectors. All the world, or any part of it, is just as exposed to attack now as was Pearl Harbor in 1941.

Research and Development for Military Purposes

The suggestion has been made by others that research should be placed in a separate agency outside the Defense Department, similar to the present Atomic Energy Commission. This, I think, is neither necessary nor desirable at the present time.

I recommend that the Army, Navy and Air Force continue their own research and development organizations in order to advance solutions of their special problems. As weapons become more complex, it is important that military people develop the operational concept, logistic support and personnel, simultaneously with the development of the weapons.

The *Assistant Secretary of Defense*, responsible for research, *should have over-all authority to coordinate the research programs of the Army, Navy and Air Force* to make sure that the whole field is adequately covered, *that the programs of the three services complement one another*, and that unnecessary duplication is avoided. Subject to the Secretary of Defense, and within the limits of the over-all amount allotted for military research, he should have the authority and the funds to make such additional contracts for research programs as the Defense Department deems necessary.

Basic Research

Basic research, the quest for new knowledge about natural phenomena, is the very foundation of engineering and technology. It cannot be neglected without ultimately weakening our entire scientific edifice. In the present complex world of technology, no country can maintain a position of leadership unless it is willing to furnish a favorable climate and reasonable support for basic research.

In recent years, the pressure for quick results has focused our main attention on applied research, on engineering and on immediate requirements. As we apply the fundamental knowledge we have acquired, the need for more such knowledge becomes apparent. Basic research is a continuing task of exploring the unknown. The very exploration uncovers new and challenging problems and possibilities. It opens up new vistas for advanced knowledge leading to still greater accomplishments. The process is regenerative. Today there is a growing realization of the dangers of neglecting this task and the scientific community has spoken out vigorously on this score.

Congress should make available adequate funds for the National Science Foundation and thereby enable that agency to assume a major role in sponsoring and coordinating basic research. We must develop an environment in which talented scientists can apply themselves to long-range objectives without

feeling compelled to fill immediate prescriptions for "hardware" in order to qualify for financial support.

It is vital that the American people should have a clearer appreciation of the role of science and the function of the scientist in our society. This would raise the calling of the scientist to a higher level in the public mind; an enlightened and sympathetic public opinion is indispensable in the new Space Age.

Submarines

All reports seem to agree that the submarine fleet the Russians now have is about five times as large as ours and that they are building additional submarines at a much faster rate than we are. If they do not already have them, it seems reasonable to believe that the Russians will have nuclear-powered submarines capable of launching intermediate-range missiles. This poses a threat to our entire system of defense, a threat that could conceivably be as imminent and potent as the ICBM.

This situation calls for the utmost effort and speed on our part to build up a fleet of nuclear-powered submarines and to improve our capability of detecting enemy submarines. Our program of missile launching from submarines deserves a major order of priority.

Anti-Missile Missiles

I believe it is feasible to build an anti-missile missile system that would provide worthwhile results and add to our national security. I recommend an accelerated effort to produce such a system.

The challenge now facing us seems to me to make it advisable that the program of anti-missile missiles be separated from the rest of the missile work. The director of this project should report directly to the Secretary of Defense. He should have jurisdiction over the funds for research and procurement and should be vested with authority to make decisions as to systems and procurement. He should work closely with the Military Services concerned with this equipment and the operating procedures it involves. The objective should be to bring anti-missile missiles to an operational stage at the earliest possible time.

The Satellite Program

My recommendation is that a coordinated program, using all available capabilities wherever they exist, should be organized under a single control. As of now, it is logical that this control be placed in the office of the Secretary of Defense. The prime need is to pursue the military potentials, and to assess and counter the military threats of the space programs of others. We should bring together all programs now in the several departments and orient them to the common purpose of obtaining the maximum amount of scientific data in the minimum time. Our objective should be not only to get a satellite in orbit, but to obtain scientific facts about outer space as a basis for future developments in scientific and military programs. As we proceed, it might become advisable to assign direction of certain aspects of the basic scientific work to some non-military agencies of the Government.

Lead-Time

In view of the rapid march of science and technology, and the significant competition America now faces, those charged with final responsibility for decision-making must be willing to accept a certain amount of risk which is inherent in any decision about new weapons or new methods for using them. In such areas as we may now be behind the Russians, it may be prudent to go into the production of certain weapons even before their full development is completed. It is important to recognize that in such undertakings there is bound to be a certain percentage of failure; but this is an element in any program designed to speed our progress and strengthen our national security.

To shorten the lead-time between research and production of military weapons, it is vital that decisions by those having final authority be made without unnecessary delay. Lead-time could also be cut down by giving contractors more leeway in making technical decisions on matters which do not fundamentally affect operation of the weapons.

Education

The immediate and long-run problems of education and training call for serious attention and prompt action on the part of Government, educators and the public generally.

It is necessary for the schools to stimulate in our youth a sense of high adventure in pushing forward the horizons of science, research and invention. Boys and girls must be helped to feel the thrill of delving into the mysteries of science, and be made aware of the wonderful worlds to be opened up for the good of all mankind. But if we are to inspire more of our able and imaginative students to follow scientific disciplines, we need better teachers wider use of the latest teaching aids.

We are faced with a shortage of qualified teachers, especially in physics, chemistry and mathematics. The fact that teachers are underpaid, that many of them can do better in private industry, is an important point that needs to be remedied. But this cannot be accomplished overnight. Nevertheless, some helpful steps can be taken immediately.

For example, I would urge prompt action on a proposal which I recommended publicly two years ago at the annual dinner of the National Security Industrial Association. At that time, I suggested the establishment of a National Educational Reserve, made up of qualified teachers of mathematics and the sciences, to be drawn from the ranks of industry. I proposed that industrial concerns release—with full pay for at least one year—a reasonable number of men and women for teaching assignments in nearby high schools. It is obviously impractical for any one company, or even a small group of companies, to carry out this plan. If it is to realize its full potential, it must have national sponsorship and a large number of companies behind it. It must also have the backing of State education authorities who would have to certify members of this Reserve to teach in their schools.

We could also improve and extend our educational facilities by more extensive use of closed-circuit television, which has been hailed by some educators as one answer to the twin shortages of teachers and schools. The commendable pioneering work done by the Ford Foundation's Fund for the Advancement of Education already has demonstrated that teaching-by-TV has many advantages. It makes possible highly realistic scientific demonstrations that are otherwise out of the question in a small classroom. It extends the exhilarating influence of the best teachers far beyond the narrow confines of their classes.

Financial Burdens

There is one factor that overwhelms all others in answering the question: Can we afford to spend the additional billions necessary for our adequate defense? *That factor is survival.* Whatever we truly need for our survival represents essential expenditures. We can afford nothing less.

Moreover, we alone can afford to maintain a defense program at its proper level for our safety without endangering our economy or deteriorating our standards of living. But if the choice must be made between securing our national defense and sacrificing our individual luxury, the decision is, of course, crystal clear. For to enjoy luxury, and particularly the luxury of freedom, we must first survive.

Cold War

The challenge we now face is on three main fronts—the military, the political and the economic. They are interrelated and interdependent. They are the essence of the Cold War which Soviet Russia continues to wage relentlessly. As the President said last week in his State of the Union message to the Congress, "The Soviets are, in short, waging total Cold War."

In our necessary concentration on technology, we must not ignore the menace of Communistic ideology which is part and parcel of the same implacable challenge. We have seen how cleverly the Communist leaders exploit their technological advances to create a phychological impact upon people everywhere. Sputnik has not only posed a challenge to our scientific leadership but has also proved to be the greatest and fastest Cold War propagandist the world has ever seen.

It is late, but not too late, to face up to the imperatives of the Cold War. In the batle of men's minds, Soviet successes have been due less to the genius of the Kremlin than to the lethargy of the West.

After all, we are not without opportunities for taking the initiative. The Soviet empire is racked by inner pressures, problems and dangers. The enemy expertly exploits our internal tensions, yet his own tensions are vastly greater.

Our basic policy should be directed toward a program that assures our supremacy on the military, political and economic fronts. It is not enough for us to limit ourselves to an effort to "catch up" with Russia. To Russia should be assigned the task of catching up with us.

Our strength—in weapons, in diplomacy, in economics and in spirit—must be such as to discourage the present Soviet strategy of intimidation and nibbling and to deter wider aggression. This position of strength would help to sustain and unite our Allies and advance the cause of peace.

The patriotism of our people, the ingenuity of our scientists and engineers, the skill of our labor, the efficiency and productive capacity of our industrial plants, and the dedicated men and women serving in the Armed Forces and in other branches of our Government—all these make it possible for us to accomplish the necessary tasks, to preserve our freedom and maintain our status as the leading nation in the world.

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Basic Research

(*Continued from page* 16)

Could it be that our preoccupation for pedagogical requirements has left no room in the curriculum for specialization in science and technology on the part of our teachers? At odd moments, I find myself thinking so when I brood over the fact that in our staff of 400 outstanding research scientists at our Research Laboratory at The Knolls there are only a very few who could obtain regular employment as high school teachers.

Following the chain of events which we must have the courage to examine critically, we come to the question of whether our Department of Defense has any legitimate business in basic research. As I have indicated, I feel this is a vital necessity. Inquiring science will provide the primary source of the new foundations upon which can be built new technology that will serve the national defense. And our competitor will not give us time to be patient with people who are still surprised and skeptical when this happens. Our Defense Department *does* have a legitimate role in this kind of research because the success of its future mission will depend increasingly upon the Department's awareness of and participation in scientific progress.

Utilization of Results

We must be equally critical of the utilization of the results of successful scientific work, which is the final event in technological progress; it is here that engineering and engineers play a major role. Progressive engineering education recognizes the eminence of technological change and its scientific origins, and reflects this trend in the college curriculum. I have no regrets to find that the old stand-by of the freshman engineer, Surveying I, is being dropped in favor of subjects more urgently in need of understanding in the atomic, electronic and space-flight age.

Because Soviet Russia is training three times as many scientists and engineers as are we, it would be easy to come to the conclusion that we should immediately treble our technical education programs. If this should take place suddenly, and American industry should have available two or three times as many engineering graduates, it would create havoc and demoralize the profession. In the solution of this problem, as in others created by the Sputniks, we have to start further back in our free enterprise system. We undoubtedly need a more adequate supply of technically-trained people, but we are *not* out of balance by a factor of three. The Soviets started from almost nothing and have a great deal of catching up to do.

Our Problem

Our problem is basically one of achieving balance between the many factors which in aggregate determine an effective program of exploring and utilizing science for the national defense. And, before we *train* three times as many technical people, we must give some thought to how we would *use* three times as many technical people.

Most important of all is the urgent necessity of determining what the gross magnitude of our technical work should be — scoping the job. This is not made easy by figures which are conveniently available today.

Reliable figures from the National Science Foundation show, for example, that the United States is spending about five-billion dollars per year on "research and development." This is a huge sum, and it would be easy to jump to the conclusion that in comparison to our total defense expenditures it must provide an adequate allocation for research. These figures are misleading, however, because we have lumped together "research" *and* "development." There is no clue in the "five-billion dollars for R & D" as to what portion is for research and, particularly, what portion is for the basic research that provides the real foundation for our technological progress. It is certain, however, from other available information, that the basic research portion of this total is extremely small.

In any comprehensive program based on technology, be it industrial or government sponsored, an effective *balance* should be sought between the basic research, the applied research, and the final production activity. There is a strong and growing feeling in civilian and government scientific circles that we are dangerously deficient and hence out of balance in the area of basic research. The Hoover Commission report of 1955 emphasized this. Numerous documents issued by high-level advisory committees of the Department of Defense have raised similar warning flags.

It may be argued that the Russian satellites are the result of a tremendous *development* effort, that they do not necessarily incorporate any new fundamental knowledge that we do not possess, and that their appearance has nothing to do with the basic research issue. This statement of the case includes some truth but is completely wrong in its implication. To put our satellite in an orbit in all haste does not require that we do any basic research; this can be accomplished with existing scientific and technical information. However, far more important than competing with Sputniks already overhead is to learn the lesson taught by all five Sputniks. *The lesson is that we must mend our scientific and technological fences, all the way from the school classroom to the missile launching pad, and we must do this so effectively that Sputnik X, carrying an atomic warhead, will never be launched.*

Missile Master

(*Continued from page* 25)

tube similar to that used in domestic TV receivers. The symbols for major target positions are controlled by a magnetic deflection system. Character painting for auxiliary data is produced by an electron gun and electrostatic deflection assembly.

Collectively, all equipment of the Missile Master results in the Nation's first fully operational electronic air defense control system. It is a remarkable achievement in research, design and development by the Army Signal Corps and The Martin Company. In the capable hands of the Army Air Defense Command, it is a major operational weapon of defense.

"What we have achieved here is only a beginning," said Secretary Brucker at the recent ceremony at Fort George G. Meade, "a milestone on the path of progress toward maximum strength for peace and security. I have the greatest confidence that the dedicated teamwork of the United States Army, American science and American industry will produce more miracles of achievement in the future than it has in the past. I am sure we will continue to go forward with ingenuity, determination and devotion to develop the instruments of war the Army needs to carry out its responsibilities as an indispensable element of our National defense."

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Keynote Luncheon, 12:30 pm
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Tour with Luncheon—Andrews Air Force Base, 12 noon
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Association affairs

Convention Professional Papers

The time for the submission of the 200-word abstract relating to the Professional Papers for the 1958 AFCEA Convention has been extended from February 1 to March 1, 1958. Rear Admiral Gordon L. Caswell, USN (Ret.), former Assistant Director of Naval Communications, who has had considerable background and wide experience in the field of communications, will head the committee for the selection of papers to be presented in June.

1958 Convention Committees Named

The 12th Annual AFCEA Convention will be held June 4, 5 and 6, Wednesday, Thursday and Friday, in the Sheraton Park Hotel, Washington, D. C.

Convention Chairman, Captain Wilfred B. Goulett, AFCEA Executive Vice President, has named the following chairmen of various committees:

The Convention Vice Chairman is Millard C. Richmond; Program Director is John R. O'Brien; exhibits will be handled by William C. Copp and Associates of New York, N. Y.; Gordon L. Caswell is in charge of professional papers and panel discussion; John F. Gilbarte is in charge of entertainment; Edward J. Girard is in charge of the banquet, buffet and luncheons; W. J. Baird is in charge of public relations; tours and transportation will be provided by George Sheets; Mrs. Dorothy Christopher is in charge of ladies' activities; Frank Martins has been given the responsibilities of treasurer.

Before the appointments of the above Chairmen, an advisory committee comprised of AFCEA members from the Washington, D. C., area held two meetings in Mr. Richmond's office. A considerable amount of detailed planning was accomplished which will pave the way for later decisions and contribute to the success of this year's convention. In addition to the above named individuals, the following attended the preliminary meetings: Mr. Thomas Jacocks, GE; Mr. Francis Engel, RCA; Mr. L. Harriss Robinson, Motorola, Inc., and Colonel Percy Black, Automatic Electric Co.

HONOR GRADUATE AWARDS

Ten officers graduating with top honors at the United States Army Signal School were recently presented the AFCEA Award for outstanding achievement.

Section 704-A—Second Lieutenant Harry E. Ruther, 3222 Grand Blvd., Brookfield, Illinois. EE, University of Arizona.

Section 704-B—Second Lieutenant Douglas L. Baker, 936 Riehl, Waterloo, Iowa, EE, Iowa State College.

Section 705 — Second Lieutenant Gener R. Reget, 6142½ Coldwater Canyon, North Hollywood, California. Military Science, United States Military Academy.

Section 706 — Second Lieutenant Leonard S. Marrella, 30 Atlantic Ave., Long Branch, New Jersey. Military Science, United States Military Academy.

Section 707 — Second Lieutenant Robert L. Anderson, Route 4, Box 140, Mesa, Arizona. General Studies, Arizona State College.

Section 708 — Second Lieutenant John S. Tuck, 22 Dartmouth Ave., Dedham, Mass. EE, Northeastern University.

Section 709 — Second Lieutenant Charles J. Elder, R R 2, Fort Recovery, Ohio. ME, Purdue University.

Section 710 — Second Lieutenant David L. Steele, 510 S. Court St., Sparta, Wisconsin. Speech, University of Wisconsin.

Section 711 — Second Lieutenant Herbert L. Magleby, Route #2, Pocatello, Idaho. ME, University of Idaho.

Section 712 — Second Lieutenant Craig A. Gipple, Columbus Junction, Iowa. EE, University of Iowa.

The Signal Officer basic course provides basic branch training for newly-commissioned officers.

Section 933, Signal Supply Officer Course. Second Lieutenant Rocco L. Russo, of Bodine Avenue, Gladstone, New Jersey, took top honors. This course trains officers to direct and supervise Signal Corps supplies and equipment.

Chief Warrant Officer Carl C. Strickland, 4021 Monitor Drive, Hampton, Virginia, took high honors in the Signal Material Maintenance Officer Course. This course trains officers to direct or supervise the acceptance testing, maintenance, repair, overhaul and reissue of damaged or defective Signal Corps equipment at both Army depot and repair shops.

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NORTH CAROLINA: Pres.—James R. Fowler, Carolina T&T Co., 122 E. St. James St., Tarboro. Sec.—John C. Coley, Carolina T&T Co., 517 Hay St., Fayetteville.

NORTH TEXAS: Pres.—H. J. Wissemann, Texas Instruments, 6000 Lemmon Ave., Dallas. Sec.—John W. Williams, 4913 Cockrell Ave., Fort Worth.

NORTHEASTERN UNIVERSITY: 360 Huntington Ave., Boston 15, Mass. Div. A: Pres.—Wilfred J. Picard; Sec.—Thomas R. King, Jr. Div. B: Pres.—Neal W. Atkinson; Sec.—Jason Brooks.

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ORANGE: Pres.—Gene S. Johnson, Box 1675, Casselberry, Fla. Sec.—Vince Meder, Radiation, Inc., 501 Commonwealth Ave., Orlando, Fla.

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ROCKY MOUNTAIN: Pres.—Col. O. W. Miller, USAF Hq. ADC, Ent AFB, Colo., Sec.—Maj. B. C. DeLosier, USAF, Box 4, HQ. ADC, Ent AFB, Colo.

ROME-UTICA: Pres.—Allan A. Kunze, Lee Center, N. Y. Sec.—Darrell S. Kirby, 904 Floyd Ave., Rome, N. Y.

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SEATTLE: Pres.—Raymond J. Laine, 521 E. 123rd Sec.—Merrill R. Stiles, 916 W. 122nd.

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SOUTHERN CALIFORNIA: Pres.—Lester R. Daniels, Daniels Engineering, Inc., 5244 Van Nuys Blvd., Van Nuys, Cal. Sec.—Col. Frank J. Shannon, Sr., Packard-Bell Electronics Corp., 12333 W. Olympic Blvd., Los Angeles 64, Calif.

SOUTHERN CONNECTICUT: Pres.—Edwin B. Hurley, So. New England Tel. Co., Box 1562, New Haven. Sec.—J. A. Leopold, Dictaphone Corp., 375 Howard Ave., Bridgeport.

SWITZERLAND: Pres.—Capt. Gerald C. Gross, USNR, Intl. Telecommunications Union, Geneva. Sec.—Robert V. Lindsey, Intl. Telecommunications Union, Geneva.

TINKER-OKLAHOMA CITY: Pres.—Delbert F. Cravens, Southwestern Bell Tel. Co., 405 No. Broadway, Oklahoma City. Sec.—Lt. Col. Albert A. Rudd, 1800 AACS Wing, Tinker AFB, Okla.

TOKYO: Pres.—Col. Thomas W. Riley, Hq. USARJ Sig. Off., APO 343, S. F. Sec.—D. A. L. Hughes (Philco), Hq. USARJ Sig. Off., APO 343, S. F.

WASHINGTON: Pres.—L. Harriss Robinson, Motorola, Inc., 1145 19th St., N.W. Sec.—John R. O'Brien, Hoffman Laboratories, Inc., 1625 Eye St., N.W.

Chapter News

Atlanta—Shown at a press conference prior to the November 19th meeting are, left to right: Chapter President Donald L. Adams; Homer Meaders, Atlanta Journal; Bill Tucker, United Press; Fred J. Friel, guest speaker from the Naval Research Laboratory; John Bent, WLW-A; Frank Wells, Atlanta Constitution, and Program Chairman W. O. McDowell.

Atlanta

"Radio Tracking Earth Satellites" was the subject of an address by Fred J. Friel of the Naval Research Laboratory at the chapter's November 19th dinner-meeting. Held at the Atlanta General Depot, the meeting drew an attendance of 250 members and guests.

The following report appeared in the *Atlanta Constitution*:

" 'No secrecy has ever cloaked America's efforts to launch an earth satellite,' an expert working on the Navy's Vanguard project said Tuesday in Atlanta.

"Fred J. Friel, Jr., Manager of Field Operations in Tracking and Guidance for the Naval Research Laboratory, Washington, D. C., made that statement at an interview before speaking to members of an Armed Forces Communications and Electronics Association meeting here Tuesday night.

"Friel said that work on the satellite project in this country was completely divorced from any military objectives and was done in the interests of the International Geophysical Year, precluding any reason for secrecy in the project.

"The expert in tracking space objects said that his group had learned from the Russians' two satellites that radio transmissions on as low a frequency as 40 and 20 megacycles would pierce the ionosphere.

" 'We plan our broadcasts from our first satellite to be on 108 megacycles,' the engineer said. 'Russia picked the lower frequencies so that transmissions could be picked up by anybody who had a shortwave set, probably. They announced at the IGY meeting in Washington three days before the launching of Sputnik I what the frequencies would be.'

"Friel said that it was entirely possible for the Russians to have 'rigged' their satellites to broadcast important information over Russian territory only.

" 'We have the same sort of plan for our satellite,' the electronics expert said. 'No idea of secrecy is involved in our plan, and probably not in the Russians.'

" 'We have our tracking stations set up on the 75th parallel, and we can operate our satellite so that it gives out information only when it is over these stations. This is done by sending a radio impulse to the satellite which will tell it to start transmitting what it has "seen." It's just a question of saving our batteries.'

"Friel said that his group was planning a 'dry run' for 'moonwatch' stations such as at Ft. Stewart, Ga., when the Russians launched their first satellite.

" 'It was the wettest dry run in history,' the expert space tracker said. 'We got observations from our stations at Ft. Stewart, in Peru, in Havana and from Australia, to mention some. We were able to set up an orbit from their observations. We sent this information to Russia.' "

Augusta-Fort Gordon

An evening of dinner and dancing highlighted the meeting of December 12th as chapter members gathered with their wives for a ladies' night banquet at Timmerman's Lodge.

Following the dinner, officers were installed for 1958. Newly elected president James M. Williams, Southern Bell Telephone Company, received the gavel from Colonel Otto T. Saar, Assistant Commandant of the Army's Southeast-

Augusta-Fort Gordon—New chapter officers were installed on December 12th. From left to right are: Col. Erling J. Foss, 3rd vice president; M/Sgt. Martin L. Jenkins, 1st vice president; James M. Williams, president; Jack R. Young, secretary, and Lt. Col. D. R. Knight, treasurer. Not present at the time photo was taken was George W. Sims, 2nd vice president.

ern Signal School and a past president of the chapter. Mr. Williams succeeded Colonel B. E. Small, Commander of the Signal Training Regiment, who served as chapter president during 1957.

Baltimore

The chapter's annual Christmas dinner-dance was held on December 20th and enjoyed its traditional success. The festive event took place in the main ballroom of the Fort George G. Meade Officers Club.

Fort Monmouth

More than 150 civilian and military members of the chapter attended the Christmas luncheon-meeting on December 17th in the Sapphire Room at Gibbs Hall Officers Club. Among those attending were Maj. Gen. W. Preston Corderman, Fort Monmouth Commanding General and Brig. Gen. Albert F. Cassevant, Commandant of the Army Signal School.

The guest speaker was A. E. Abel of the Bendix Corporation, Towson, Maryland, who talked on "Advances in Electronics," following the luncheon. Halsey Hubbard of the Army Signal Equipment Support Agency, chapter president, presided.

Frankfurt

The official organizational meeting of the Frankfurt Chapter was held at the Frankfurt Officers and Civilian Club on October 18th. Guest speaker of the evening was Col. Winfield L. Martin, Signal Officer, V Corps.

The interim president, George A. Spear, opened the meeting with a review of the history of the Association and the former European chapter which had been active in Frankfurt for a number of years after its organization in 1947.

Col. D. S. Prescott, chairman of the nominating committee, submitted the recommendations of the committee and the following slate of officers was elected for the coming year: president

Northeastern University—The chapter awarded Joel Chase, center, an AFCEA lapel button for outstanding service as publicity chairman. Admiring the award are, left to right, Maj. Fred J. Frank, chapter advisor; William C. Regan, Jr., secretary; Fred Picard, past president; Edward O'Keefe, president, and Thomas R. King, Jr., vice president.

—Col. W. L. Martin, Hq. V Corps; vice presidents—Lt. Col. J. M. Raleigh, 32nd Sig. Bn.; C. A. Webb, Jr., Emerson Tech. Reps.; George A Spear, Engr. Sec. FSA; treasurer—R. L. Prokop, Sig. Proc. Center; secretary — Capt. H. W. Killam, 102nd Sig. Bn., Co. A.

President Martin assigned duties to the vice presidents as follows: assistant to the president—Mr. Spear; membership—Lt. Col. Raleigh; constitution and by-laws—Mr. Webb.

Plans were made for a vigorous membership drive and for a program of regular chapter meetings.

Kansas City

Prinicipal speaker at the chapter's December 11th dinner-meeting, held at the Sales and Advertisers Executive Club, was James E. Gardner, Vice President of the Wilcox Electric Company.

Mr. Gardner's subject was "The Potentialities of Single Side Band Techniques of Aircraft Communications" and covered comparative advantages and disadvantages between single side band and double side band circuits.

Frankfurt, Germany—George A. Spear, interim president, presents the official charter of the Frankfurt Chapter to Col. W. L. Martin, Signal Officer, V Corps, newly elected president.

New York

The program of the chapter's annual meeting on December 18th, held at the Biltmore Plaza Hotel, featured a lecture-demonstration on "Solid State Electronics" by Robert P. Jutson of the Bell Telephone Laboratories.

The election of new officers for 1958 took place during the business session, with the following result: president—Col. Ludwig R. Engler, RCA Communications, Inc.; vice presidents—Henry R. Bang, New York Telephone Co.; Edwin C. Carlson, Mutual Life Insurance Co.; Lt. Col. David Talley, International Telephone & Telegraph Co.; secretary — Thomas Brown, IV, New York Telephone Co.; treasurer — Lt. Col. R. Hearn, Bell Telephone Laboratories; recording secretary—Capt. O. S. Ostberg, IT&T Co.; member of executive committee — Col. Benjamin H. Oliver, Jr., American Telephone & Telegraph Co., retiring president; board of directors—George W. Bailey, Institute of Radio Engineers; Rear Adm. R. W. M. Graham, Raytheon Manufacturing Co.; F. A. Gunther, Radio Engineering Laboratories; Lt. Col. W. L. Hallahan, Laird & Co.; J. V. L. Hogan, Hogan Laboratories; W. A. Kirsch, Fairchild Camera & Instrument Co.; F. R. Lack, Western Electric Co.; Maj. Gen. F. H. Lanahan, Federal Electric Co.; Maj. Gen. R. C. Maude, Allen B. DuMont Laboratories, Inc; C. F. McElwain, International Business Machines Corp.; Col. Julian Z. Millar, Western Union Telegraph Co.; Col. T. H. Mitchell, RCA Communications; Milton G. Nattress, Jr., N.Y. Tel. Co.; Maj. Theodore N. Pope, Bell Tel. Labs.; Rear Adm. Ellery W. Stone, American Cable & Radio Corp., and J. L. Strauss, The Lewyt Corp.

Mr. Jutson demonstrated some of the latest solid-state devices of the Bell Telephone Laboratories. These included miniature silicon rectifier elements, transistors, and solar batteries. He demonstrated some novel uses of transistors in a computer and a translator.

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This included the selection of a card from an ordinary deck of cards by the new chapter president, Col. L. R. Engler, who, after some mental computations, gave a coded number to the transistor translator computer which immediately by a series of lights indicated the correct card which he was holding. A motion picture film on "The Bell System Solar Battery and its Applications in Telephone Work" also was shown.

Philadelphia

Members, their wives and guests turned out in good number for the chapter's annual Christmas cocktail party, dinner and dance.

The Officers Club at the Philadelphia Naval Base was the scene of the holiday celebration.

Pittsburgh

A buffet supper and dance at the East Liberty Armory on December 13th marked the chapter's holiday activity.

Added attractions were door prizes, as well as three grand prizes which consisted of an RCA Hi-Fi set and two 17" RCA portable TV sets.

Scott-St. Louis

The celebration of the chapter's sixth anniversary took place on December 10th. Present to congratulate the chapter and also give reports on AFCEA national and local activities were AFCEA's National President, Rear Adm. F. R. Furth, USN (Ret.), and AFCEA's Executive Vice President, Capt. Wilfred B. Goulett, USN (Ret.).

Principal speaker was Brig. Gen. Albert T. Wilson, Jr., Deputy Chief of Staff for Operations, Headquarters, Military Air Transport Service. His address on the subject of "What MATS Means to Our National Defense" covered the over-all mission of MATS as well as the contribution of each of its subordinate commands, such as Airways and Air Communications Service (AACS), Air Weather Service (AWS), Air Sea Rescue Service (ASRS), etc.

Scott-St. Louis—Pictured at the November meeting, left to right: B. R. Robards, vice president; Col. C. W. Gordon, president; Col. W. E. Groves, who addressed the chapter on the subject of "Combat Surveillance, Today and Tomorrow;" Col. W. D. Cairnes, and A. L. Eisenmayer, secretary.

The chapter paid tribute to its president, Col. Charles W. Gordon, who was retiring from the Air Force. A special film made of the review and parade at Scott Air Force Base in honor of his retirement was shown to the gathering. A gold AFCEA lapel button was presented to Colonel Gordon on behalf of the chapter by Secretary Allan Eisenmayer in token of his outstanding service as chapter president. A gold button was also presented to Walter W. Van Skiver, the immediate past president of the chapter.

The change in leadership was effected when Colonel Gordon turned over the gavel to B. Rogers Robards, chapter vice president, who succeeded to the presidency for the balance of the 1957-58 term.

The meeting took place at Augustine's Restaurant in Belleville, Ill., and was preceded by a cocktail hour and dinner. Dancing followed the formal program.

Seated at the head table were: General Wilson; Col. and Mrs. Gordon; Admiral Furth; Captain Goulett; Mr. and Mrs. Robards; Rear Adm. Robert E. Melling, USN (Ret.), and Miss Melling; Mr. and Mrs. Eisenmayer; Col. and Mrs. William D. Cairness, and Miss E. Reynolds of General Wilson's staff.

South Carolina

The board of directors and committeemen of the chapter met on December 19th at the Officers Mess of the Charleston Naval Shipyard to formulate plans for the next meeting and conduct other business at hand.

Present were: Comdr. Harry C. Rodin, president; W. O. Kiger, first vice president; F. L. Davis, secretary-treasurer; W. L. Schachte and C. A. Ducker, membership committee; W. F. Reilly and A. T. Stephens, program and publicity committee; E. D. Biggerstaff, Comdr. J. G. Cormack and E. C. Figg, guests.

Named to fill vacancies in the executive organization of the chapter were: Maj. Frank S. Barnes, Jr., of the Rock Hill Telephone Company, who was made a member of the board to replace Hugh Pulliam; also E. D. Biggerstaff of Charleston Naval Shipyard who was appointed chairman of the membership committee to succeed W. L. Schachte.

South Texas

Maj. David G. Simons, the Air Force officer who last summer soloed in a balloon at a record altitude of more than 100,000 feet, was the feature speaker at the chapter's December 10th dinner-

South Carolina—An executive committee meeting held December 19th was attended by the group above. Seated, left to right: Cdr. J. G. Carmack, USN; Cdr. H. C. Rodin, USN, president; W. O. Kiger, 1st vice president; F. L. Davis, secretary-treasurer, and W. F. Reilly, program and publicity chairman. Standing, left to right: E. D. Biggerstaff, Jr., membership chairman; E. C. Figg, member of the board of governors at The Citadel; A. T. Stephens, program and publicity committee, and W. L. Schachte and C. A. Ducker, membership committee.

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meeting at Randolph Field Officers Club.

The chapter recorded the best turnout of the year to hear Major Simons' vivid, illustrated account of his record journey in an aluminum capsule to the fringe of outer space.

Southern Connecticut

On December 12th, chapter members and guests heard Lincoln Thompson, Vice President of Raymond Engineering Laboratory, Inc., and a past president of the chapter, present a program on "Independent Research and Development Facilities."

Mr. Thompson stressed the increasing emphasis on research and development —both military and civilian; the need for custom production facilities as a parallel service, particularly in the missile field; the growth of his company, Raymond Engineering Laboratory, gauged to fill those needs, and gave a particularly interesting demonstration of the mechanism made by Raymond for separating the satellite from the third stage of the missile.

The talk was topped off by a showing of a seven-minute film describing plans for tracking earth satellites.

Switzerland

The chapter's annual business meeting took place at the Hotel de Bergues, Geneva, on December 14th. Among the guests present were Col. Frederic H. Dickson, a member of the Fort Monmouth Chapter, and Dr. F. Gautier of the National Bureau of Standards, Boulder, Colorado.

The following officers were elected to serve during 1958: president — Capt. Gerald C. Gross, USNR, International Telecommunication Union; vice president for Geneva—F. Chevalier, International Automatic Electric Sales Co.; vice president for Berne—Col. R. Miller, USA, U.S. Military Attaché in Berne; vice president for Zurich—R. H. Holz, Radio Corporation of America, Zurich; secretary-treasurer—R. V. Lindsey, International Telecommunication Union; chairman, membership committee—D. E. Stacey, Lenkurt Electric Company; chairman, program committee—Jack Reid, Radio Corporation of America, Geneva.

Washington

"Air and ground landing forces of the modern Marine Corps demand close control and coordination through radio communications and electronic devices," stated Brigadier General Richard C. Mangrum, USMC, who spoke about the modern Marine Corps at the regular luncheon-meeting of the Washington Chapter on January 7th at the Willard Hotel.

"It is imperative," said General Mangrum, "that landing forces retain their high tactical mobility after they land. For this we will rely heavily on helicopters." Pointing out that the direct beach assault from the sea will gradually assume a lesser part in amphibious operations, he said: "Ultimately, beaches will be required only for the introduction of heavy combat vehicles, equipment, logistic support, and these beaches will be seized from the flanks or rear by helicopter-landed assault forces."

New type radio relay equipment is the best answer to the problem of communication between dispersed Marine units, according to General Mangrum. Other new "black box" developments for use by the Marines include combat surveillance equipment and light-weight helicopter-transportable air search radar equipment.

General Mangrum's presentation covered the kind of war we must expect in the future—both general and localized. He stated that when major powers reach a capability of destroying each other, however, there will be an intensification of the cold war and some form of limited warfare—which will undoubtedly, sooner or later, involve participation by elements of the Marine Corps.

Seated at the head table during the luncheon were General Mangrum; Col. Kenneth D. Kerby, USMC, Director of Aviation; Col. James G. Bishop, USMC, Head of Communications and Electronics Branch, G-4; Col. Frederick P. Henderson, USMC, Head of Development Branch, G-4; Lt. Col. Robert L. Cochran, USMC, Head of Aviation Electronics Branch, Division of Aviation; Maj. Gen. Henry R. Paige, USMC, Assistant Chief of Staff, G-4; Col. David W. Stonecliffe, USMC, Assistant to Assistant Chief of Staff, G-3; Lt. Col. Arnold W. Harris, Senior Marine Officer in Navy Bureau of Ships for Electronics; Capt. Wilfred B. Goulett, USN (Ret.), AFCEA Executive Vice President, and Mr. William C. Copp of William C. Copp and Associates, AFCEA national advertising representative.

Washington—Brig. Gen. Richard C. Mangrum, USMC, Deputy Assistant Chief of Staff, G-3, who was the main speaker at the January luncheon.

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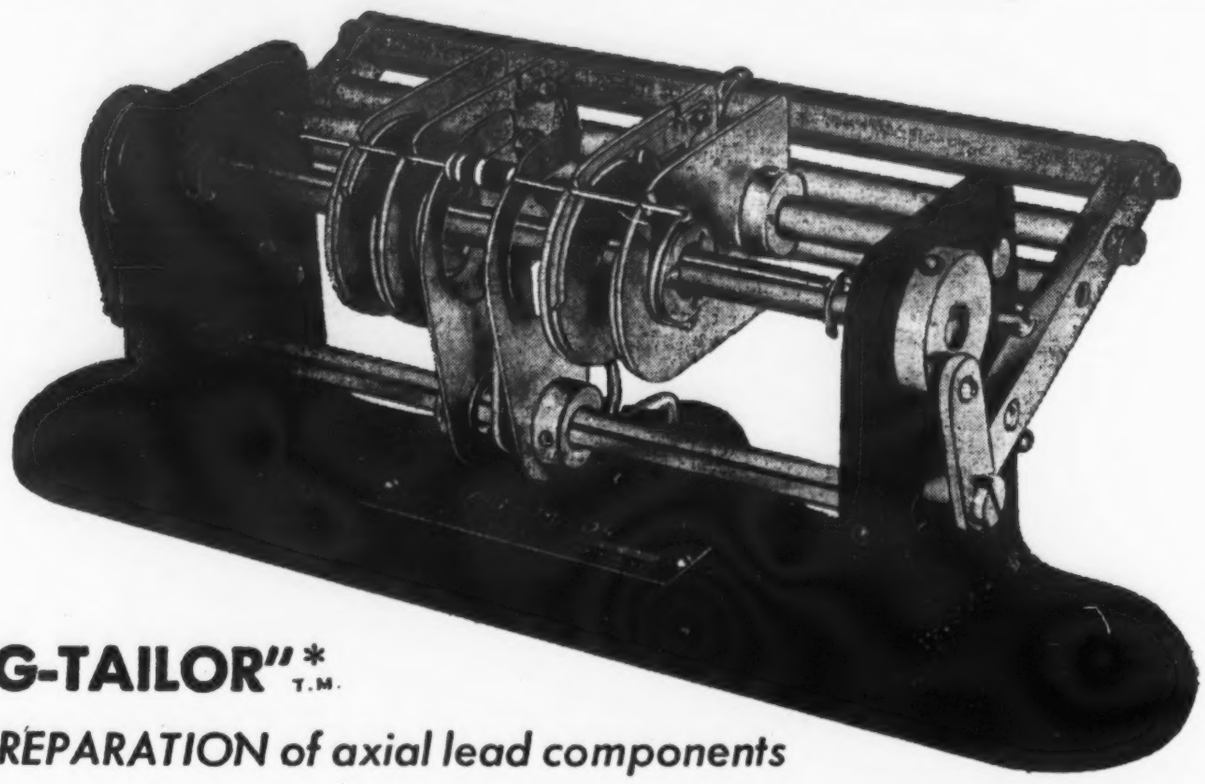

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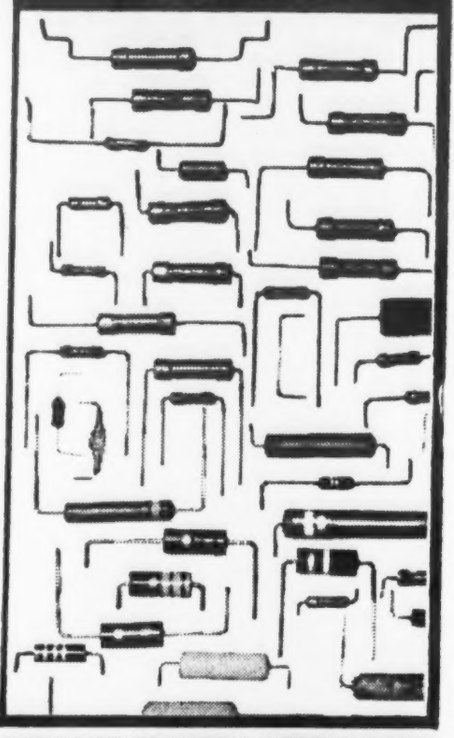

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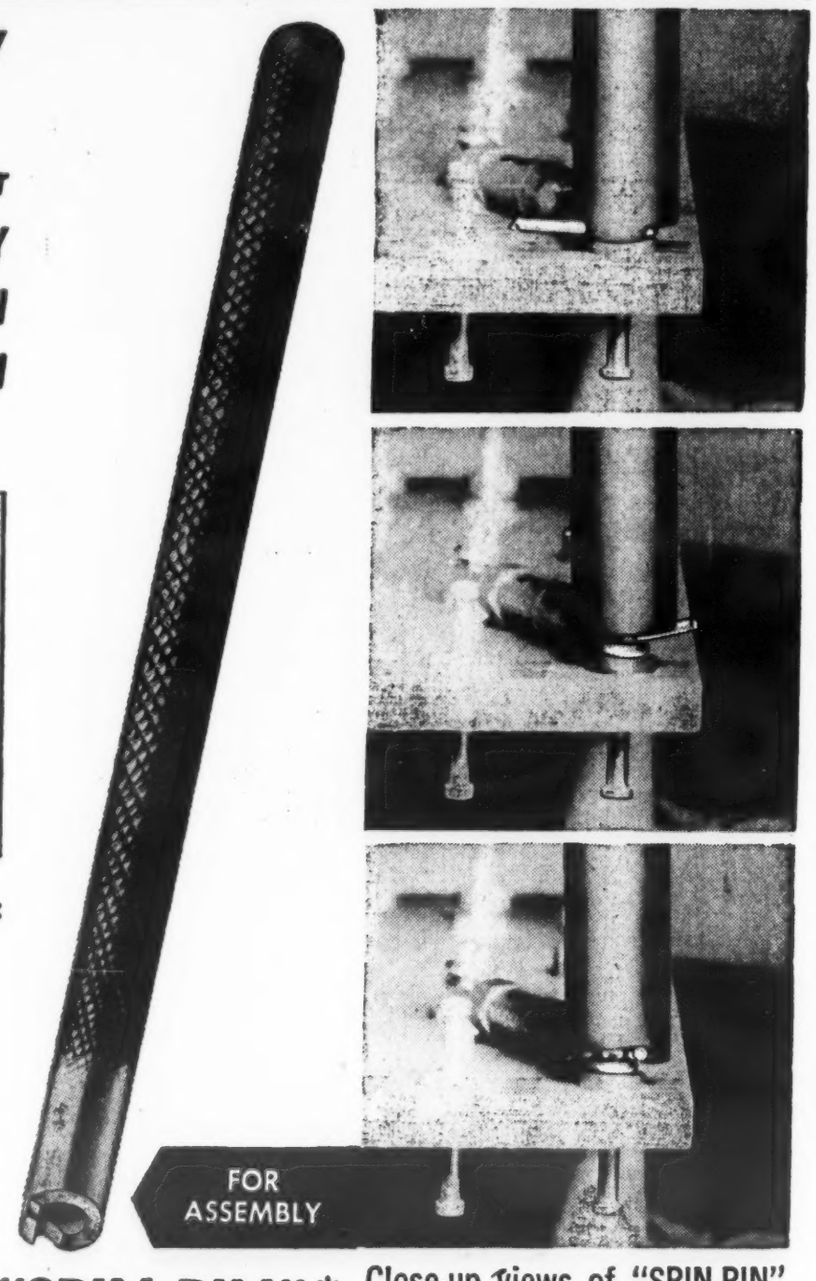

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ITEMS OF INTEREST

From Government, Industry and the Services

Electric Currents In Atmosphere

According to a recent report, scientists are examining the theory that the magnetic effects observed on the earth during magnetic storms may be due to great electric currents flowing around the earth high in the atmosphere.

The information was contained in a document which presented a brief account of some of the U.S. activities during the first five months of the International Geophysical Year. This summary was compiled by Hugh Odishaw, Executive Director of the U.S. National Committee for the International Geophysical Year.

"Newly established United States IGY geomagnetic stations are in operation," the report states, "in the Arctic, in the Pacific Ocean, in continental United States, and in South America with the cooperation of IGY scientists in Peru. Certain of these stations are set up in chains, with carefully planned spacing, to study in detail the magnetic storms which occur during great solar disturbances. It has been suggested, but not before positively established, that the magnetic effects we observe on earth during magnetic storms may be due to great electric currents, of perhaps several hundred thousand amperes, flowing around the earth high in the atmosphere. Two of these currents are believed to circle the North and South magnetic poles while the third circles the earth at the geomagnetic equator. This theory is being examined."

Fast Shutter

A camera shutter so fast it makes possible the taking of photographs at the rate of one exposure in five billionths of a second has been developed for the Department of the Army.

The new shutter, which is expected to prove important as an Army research tool, is the product of Electro-Optical Systems, Inc., of Pasadena, Calif. It will be used in helping to solve problems of a scientific nature in the study of high-speed shock waves, explosives and explosions, and certain nuclear reactions.

The secret of the shutter is in a hermetically sealed, large aperture, wide angle cell which has no moving parts. This cell contains a chemical which has the capability of being "pulsed" electronically. The molecules of this chemical will not permit passage of light in "closed shutter" condition, but an electrical impulse will realign them to permit transmission of the image to make the picture. With further refinements of the technique involved, it is hoped that a camera may be designed capable of making pictures with an exposure time of only a fraction of a billionth of a second.

Component Workable After Impact

Scientists of Sperry Gyroscope Company have confirmed the ability of precision electronic components, withstanding shocks of 100 g's, to work perfectly after shattering explosion and impact in test flights of long-range missiles.

In a recent instance, after mid-air explosion and 1½ mile free-fall impact against the sea, a super-rugged electronic oscillator proved to be precise within 0.01% of its "ideal" operating frequency. The component later dredged from the ocean floor and returned to the laboratory, had been a key part of a long-range missile deliberately blown to bits during the final phase of its supersonic test flight from Cape Canaveral, Fla.

The device is a precision klystron oscillator developed by Sperry for a critical guidance and data system produced for several missiles. It was returned to Sperry 'electronic laboratories for study by shock and vibration experts.

Transportable Terminal

A compact, air-transportable radio communication terminal with an antenna that inflates like a balloon has been designed and built for the U. S. Army Signal Corps by Collins Radio Company of Cedar Rapids, Mich.

The device is capable of being completely packed in two metal "huts" that serve as shelters when the station is erected. This terminal provides the greatest mobility available today for radio communication called "Transhorizon." This mobility improves the effectiveness of fast-moving Army tactical units needing communication to points beyond the horizon.

The Transhorizon method, based on the scattering effect of radio waves, provides extremely reliable radio communication for ranges of 50-150 miles without intermediate relays. Up to 12 voice or 96 teletypewriter messages or any combination of both can be transmitted or received simultaneously at the single station. It operates in the ultra-high-frequency range, just above that currently used for most television channels.

Manned Aircraft In Space

By spending between $200 and $300 million now, the U. S. would be able to put a manned aircraft into space "in less than three years," the President of the Aircraft Industries Association, Orval R. Cook, declared recently. He indicated the aircraft industry today has available "most of the hardware and all of the basic knowledge needed to send a man into space."

Mr. Cook pointed out that manned and unmanned spacecraft are outgrowths of the guided missile program and missiles, in turn, are evolved from manned airplanes.

According to the AIA President, in the "near-hypnotic regard" for the missile, the fact that at least two more generations of manned aircraft will be built is largely ignored.

He predicted the next generation of bombers will aim for speeds of Mach 3 and altitudes on the order of 75,000 feet, and fighter performances will be even greater.

295-Mile System

Philco Corporation's Government and Industrial Division has been awarded a contract to build a 295-mile communications system for the Air Force Eglin Gulf Test Range.

The project will include a 115-mile microwave relay system and a 180-mile, single hop, tropospheric scatter

system. This over-the-horizon scatter hop will span the Gulf of Mexico from Cape San Blas to Anclote Point, about 25 miles northwest of Tampa, Florida.

Such hops are acomplished by reflecting radio signals off the earth's troposphere; the signal is transmitted at extremely high power from large parabolic antennas. Philco will build two 60-foot parabolic antennas at each end of the 180-mile hop.

Estimated cost of the project, to be completed within 18 months, stands at two million dollars.

Component Distribution

Schweber Electronics, Mineola, L. I., N. Y., recently completely enlarged facilities in connection with their concept of "highspeed service" in the field of electronic component distribution.

One of the main problems the U. S. Missile Program has faced is said to be the time-lag between the manufacture of electronic components and their delivery to the project.

The Long Island firm reports that their service is founded on four basic concepts: 1. complete concentration upon a limited number of major lines, under one roof, 2. an inventory in depth of each component line, 3. a well-informed staff of engineers and salesmen-specialists, 4. an efficient inventory control system.

Gyro Compass Field Instrument

The Autonetics Division of North American Aviation, Inc., has developed a gryo compass field instrument capable of automatically determining accurately true North.

Designated ABLE (Autonetics Base Line Equipment), the direction finding, ground-based device operates in all weather, day or night. Aiming and calibration problems normally can be solved with transportable ABLE by inexperienced personnel in less than 30 minutes at 30 degrees latitude or one hour between 60 to 70 degrees latitude. Alignment adjustments are made by using a multiposition switch with the numbered switch positions indicating controls to be used to nullify an indicator.

Readout is available through a standard transit or theodolite, which then can be rotated through an angle to align missile launchers, mobile radars or other angle-calibrated equipment.

With minor modification, ABLE is adaptable for automatic angle reference in an integrated system.

New Western Office

Chicago Aerial Industries, Inc., designer and manufacturer of aerial reconnaissance systems, has announced the opening of a western regional office in Los Angeles.

Among the company's developments in the field of reconnaissance are the shutterless Sonne Strip Camera, NCCS-4 Camera Control System and automatic Image Motion Compensation Systems.

Shock-Proof Plant

St. Petersburg, Fla. is the site of a $4½-million structure built to develop the most advanced type of electronic "brains" yet devised for automatic guidance of missiles and rockets.

The plant has been so thoroughly "shock-proofed" — through unusual scientific and construction techniques — that vibrations, so small "they would barely tickle a fly's foot," can be measured inside antiseptically clean testing laboratories.

The "brains" or inertial guidance systems are a new navigational concept that permits guidance without reference to radar, radio, beam guidance, star tracking or human pilot.

According to M. P. Fedders, General Manager of the new plant, "The precision required in the development and testing of the self-navigating systems is so great that the 'swooshing' of the surf in the Gulf of Mexico 10 miles from here posed a vibration problem for us."

In designing the 98,000-square-foot building, engineers even took into consideration vibrations transmitted by swaying palm trees. This effect was negligible but, among other measures taken, a moat surrounds the plant to prevent water from settling around the foundation. Keeping the ground near the plant dry "shorts out" vibrations which travel much easier in wet soil.

Names in the News

Dr. Robert M. Page has been appointed Director of Research at the Naval Research Laboratory. His duties will include the direction and coordination of the Laboratory's overall research program which includes research in 14 fields of the physical sciences. Dr. Page, who built the first pulse radar system in the U. S., previously served as Associate Director of Research for Electronics at NRL.

Richard A. Maher was recently named Vice President—Engineering, Hoffman Laboratories, Inc. Mr. Maher will supervise all engineering projects of the company, including such fields as radar, communications, navigation, countermeasures, sonar, fire control and guided missiles.

Colonel Frank J. Shannon, USAF (Ret.), Secretary of the Southern California Chapter of AFCEA, has joined Packard-Bell Company in the Technical Products Division as Manager, Technical Field Service. Col. Shannon was formerly Manager, Engineering Liaison, Pacific Mercury Television Manufacturing Co. (Joplin, Missouri Division).

Rear Admiral Frank Virden, USN, will succeed **Rear Admiral Henry C. Bruton, USN**, as Director of Naval Communications in August, 1958. Admiral Bruton will be assigned Director, Communications-Electronics, Joint Staff, Commander in Chief, European Command on June 23, 1958. At present, Admiral Virden is serving as Joint Staff, Commander in Chief, U. S. European Command.

Edward N. Dingley, Jr., Staff Research Engineer, Electronic Communications, Inc., St. Petersburg, Florida, has been named to the honorary grade of Fellow by the American Institute of Electrical Engineers "in recognition of his many contributions in the field of electrical engineering to the defense of the United States." Captain Dingley (USNR-inactive) was engaged in electronic research and development for the Government for 27 years prior to his retirement in 1957.

Herbert H. Schenck will assume duties March 1 as Director of Engineering, Page Communications Engineers, Inc. He was recently Managing Director of Companhia Radio Internacional de Brasil and Vice President and Director of Standard Electric S.A., Rio de Janeiro subsidiaries of IT&T Corp.

Rear Admiral William B. Ammon, USN, in May, 1958, will take over the post of Deputy Commandant, National War College, Washington, D. C. At the present time, he is Commander, Naval Forces, Marianas.

Rear Admiral Ellery W. Stone, U.S. N.R., President of American Cable & Radio Corporation, recently accepted the Department of Defense's Reserve Award for his company. An affiliate of the International Telephone and Telegraph Corporation, the corporation was cited by the Department of Defense "for outstanding cooperation with the Reserve Program of the Armed Forces."

Small, lightweight Three Commutator Dynamotor for airborne transmitting and receiving equipment

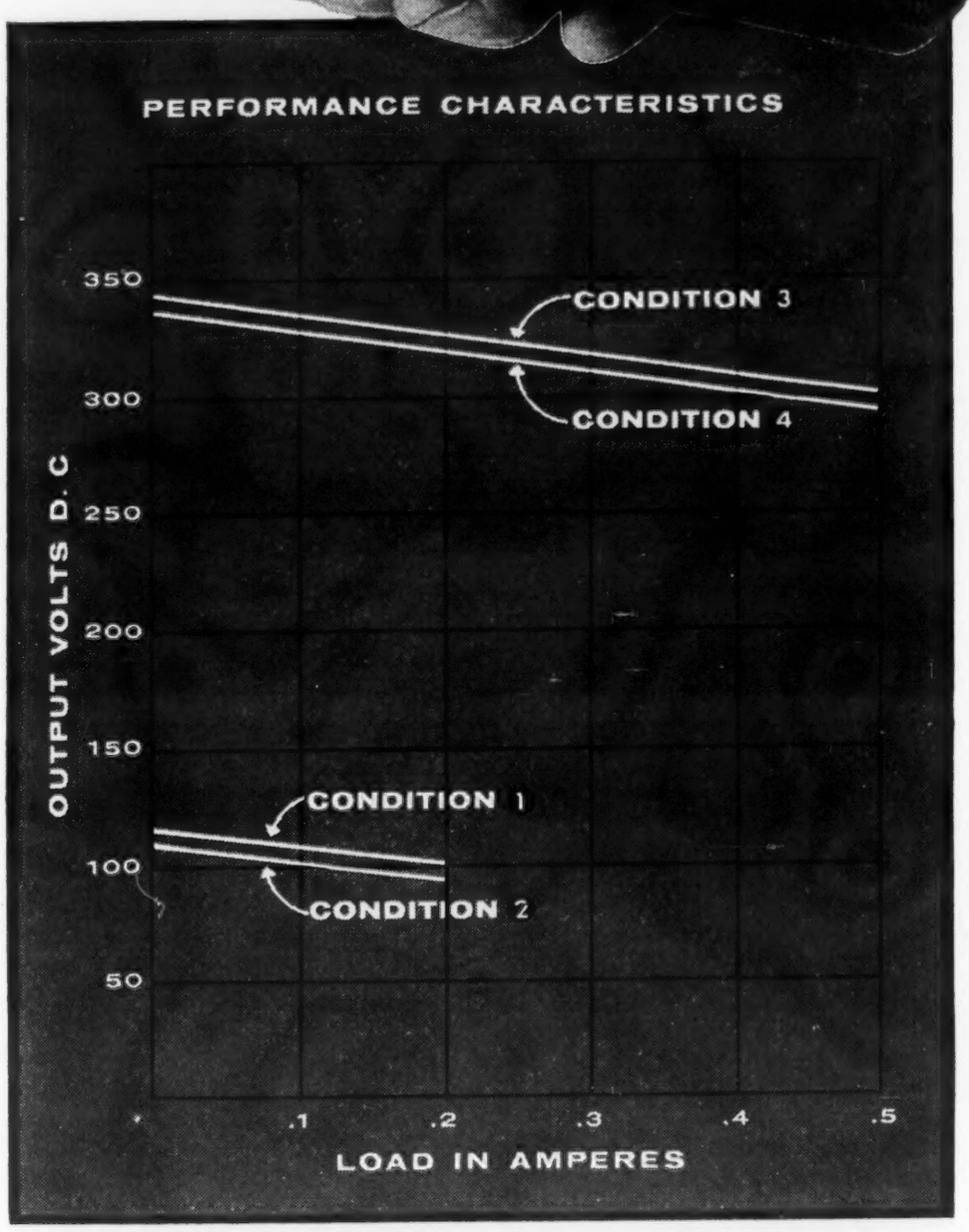
SANGAMO SP 17

(DUAL OUTPUT or DUAL INPUT)

Here is a "two-in-one" dynamotor that is small in size, light in weight, and highly efficient for both transmitting and receiving equipment. Its quality is consistent with MIL-D-24 specifications for aircraft, marine, and "Hi-Gee" (missile) usage.

	Weight	6 lbs.
	Diameter	3½"
	Length	7"
Typical Rating:	Input 26 volts at 10 amperes	
	Output A 100 volts at .200 amperes	
	Output B 300 volts at .500 amperes	
	Temperature rise 30°C	
	Ripple voltage 1% maximum	

Performance characteristics of the SP17 are shown in the chart at left.



SP17 DUAL OUTPUT

CONDITION ❶ = Output A with no load on B
CONDITION ❷ = Output A with full load on B
CONDITION ❸ = Output B with no load on A
CONDITION ❹ = Output B with full load on A

SANGAMO GY-25 "TWINVOLT"

This dynamotor, originally designed for mobile communications equipment, operates at full efficiency at either 6 or 12 volt input, but can be either dual input or dual output. Maximum output 180 watts, intermittent duty.

Write for full information, or for engineering help with your power planning. Sangamo's engineering staff will be glad to assist you.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

SG58-1

NEW PRODUCTS FROM INDUSTRY

The Varicap Capacitor

A tiny electronic component no larger than a teardrop, the Varicap Capacitor automatically observes and maintains color fidelity in a color TV picture, as well as other reputed functions.

Manufactured by Pacific Semiconductors, Inc., of Culver City, Calif., the unit is a member of the solid-state device family. In one application, it is claimed that the Varicap, a resistor, and a mica capacitor replaced 24 components.

The unit's capacitance is varied by changing an applied bias voltage.

Ultra-Magnifier For Electron Microscope

Quadrupling the enlarging power of RCA's model EMU-3 electron microscope, an ultra-magnifier has been developed by the Industrial Electronic Products Division of Radio Corporation of America.

The RCA microscope makes photographs by means of an automatic camera system housed within the microscope, and the new device will permit it to enlarge more than one million times the specimens being pictured, without deleterious grain effects.

The increased enlarging power is achieved by a newly developed intermediate lens pole-piece which focuses the microscope's electron beam.

Available in a "do-it-yourself kit," the device is composed of the new lens pole-piece and a compact electronic control unit for installation on the microscope control panel. This control panel has a 9-step switch allowing the operator a varied magnification over the high range.

Improved Design In Kato Generator Line

Kato Engineering Co., 1415 First Ave., Mankato, Minnesota, has announced improved design features in its single-bearing and two-bearing close-coupled 60-cycle generator line for adaptation to commercial gasoline and diesel engines.

Reduced weight and ease of assembly or disassembly has been accomplished by elimination of the exiter endbell bearing, with exciter armature supported by the main alternator bearing. Accuracy and ease of alignment of the generator to the engine is a result of a reduction in length of the mounting feet. There has been additional improvement in the design and placement of the outlet box and control panel.

Two typical models of the new compact 60-cycle, 3-phase generator line are the revolving armature type extending from 400 to 500 watts, and the revolving field type extending up to 400 kw. Single-phase, 60-cycle alternators are also available as large as 100 kw.

Improved Communications Receiver

Designed for either mobile or fixed station operation, a new full-fledged 12-tube all-band unit, designated the Pierson KE-93 Communications Receiver, is announced by Automation Electronics, Inc., 1500 W. Verdugo Ave., Burbank, Calif.

The extremely compact receiver, measuring only 6 x 5 x 9 inches, will deliver high over-all performance on 7 bands: 10, 15, 20, 40, 80, 160 meters, and broadcast band. Its new functional design with simplified control operation features a dial which displays only the band in use and indirect illumination of the entire front panel. Noise-suppression circuitry permits quiet operation between stations without the danger of passing up weak signals.

Dual conversion circuitry of this latest amateur receiver is free from image and spurious responses. Quadruple-tuned I.F. networks offer 3 K.C. selectivity. Universal mounting brackets for mobile mounting are included with each receiver.

High-Capacity Memory Unit

A high-capacity and rugged air-floating disk magnetic memory unit, used in the portable, general purpose digital computer, "Recomp," has been developed by Autonetics, 9150 E. Imperial Highway, Downey, Calif.

Intricately arranged over a 8-inch-diameter head plate are 88 separate recording heads, allowing information packing density of the unit to be 5 times greater than the average rotating magnetic memory unit.

It is claimed that the memory units have operated over 1300 hours without any required maintenance.

Printed Transistor For Micro-Miniaturization

A significant breakthrough in efforts to reduce the size of electronic circuits has been accomplished with the speck-sized transistor for printed electric circuits, developed at the Diamond Ordnance Fuze Labs (DOFL), a branch of the Army Ordnance Corps at the National Bureau of Standards.

Under powerful microscopes, the process of fitting a caseless transistor —a tiny die of metallic germanium— into a printed electrical circuit was worked out. Insulated wires, resistors and capacitors are replaced by simple trails of metallic ink, printed on wafer-like plates about the size of a postage stamp.

The new technique allows use of 200 transistors with associated components in a cubic inch. DOFL scientists expect, eventually, to pack 1000 transistor units in the same amount of space.

Claimed to permit such applications as man-portable versions of computers now filling large rooms, minute hearing aids tucked into a corner of the ear and eventual watch-sized radios, the new units also are said to withstand more shock and vibration and to offer more reliability than their predecessors.

Camera Takes Heat Pictures

Thermal photography, the new technique for taking pictures of the infrared radiation, or heat, given off by an object, has been developed by the Barnes Engineering Company of Stamford, Conn.

On black/white photographs, objects pictured are clearly recognizable, but the black/white shading indicates gradations of emitted heat intensity rather than reflected light. Sensitivity of the camera allows detection of temperature differences as small as .02°C. Entire assembly weighs about 100 pounds.

While thermal photography has many military applications, it is believed industry will make widest use of the technique in scanning equipment and processes for potential sources of trouble. In the aviation field, it provides a new tool for study of temperature distributions of models in sonic and supersonic wind tunnels.

The Customer is Always Right!

Whether you're one of the more than 50,000 radio-electronics engineers who will attend this year's convention and show or one of the 800-plus exhibitors, you made this what it is today. It's big... but just big enough to bring you all that's new in radio-electronics research and development!

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New Literature

Russian Journals Translated And Synthesized

International Physical Index, Inc., of 1909 Park Ave., New York 35, N. Y., has announced a new series of monthly publications which will offer, by means of expert translation and scanning of more than 60 leading Russian professional journals, a thorough coverage of all new Soviet developments in 3 major fields: electronics, automation and physics.

Each of the 3 monthly services will include 2-4 complete articles, 20-30 summarized digests and about 30 abstracts of articles. Also, there will be 100 or more annotated titles of other currently published material and about 150 diagrams, tables, charts, figures and equations.

Sources and other related data will be grouped under subject headings. An author index will permit following the output of a particularly helpful individual writer.

Designated the EXPRESS services, the publications will begin early in 1958 and estimated cost is said to be less than $5.00 monthly for each service.

DATA Defense Directories and USAF Ten-Year-Study Evaluation

DATA Publications of 1346 Connecticut Ave., N.W., Washington 6. D. C., has published a revised compilation of up-to-date names, titles, offices, phone extensions and responsibilities of personnel who fill key posts in the Department of Defense and agencies.

Printed in chain-of-command diagram-format, on sturdy 17 x 22" charts, the 3 selections currently available, at a price of $1.00 each, are: Defense Internal Who's Who (C-1); Navy Key Personnel Who's Who (C-2); Army Key Personnel Who's Who (C-3); Air Force Who's Who (C-4), and Who's Who in ONR, T-3 Bldg. (C-5).

Also available from DATA is the U. S. Air Force ten-year-study evaluation of unidentified flying objects. Service charge is $1.00.

Navy Report on Minitrack

The 31-page report, PB 131220 *Project Vanguard Report* #18, *Minitrack Report* #1—*Phase Measurement*, by C. A. Schroeder, C. H. Looney, Jr., and H. E. Carpenter, Jr., of the Naval Research Laboratory, is the first of a forthcoming series on Minitrack giving detailed information on the phase measurement portion of the system. Priced at $1.00, the report may be ordered from Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.

Minitrack is the phase-comparison system which receives through 8 antennas the signals from the low-power, lightweight transmitter in the satellite; it measures the angular position of the satellite as it passes through the antenna beam, recording its "signature" automatically without need for additional tracking information. Analysis of this signature provides the complete angular history of the satellite passage.

Atoms For Economic Development

"If we are to be ready to make use of nuclear power when it is economic for us to do so, we must now begin to prepare ourselves."

The booklet entitled "Atomic Energy In Economic Development" contains the contributions of 4 leading experts in the field of atomic energy: Lewis L. Strauss, Sir Edwin Plowden, Sir John Cockcroft and W. Kenneth Davis. Its contents reproduce the informal panel discussion held on September 27, 1956, at the 11th annual meeting of the Board of Governors, International Bank For Reconstruction & Development, Washington 25, D. C. From this address, the booklet may be obtained at no cost.

Photography Through The Microscope

"Photography Through The Microscope," the revised second edition of Kodak's data book regarding elementary photomicrographic technique, offers up-to-date coverage of current materials, equipment and techniques. The 72-page illustrated book may be obtained from photographic dealers at the price of 75¢.

Treatment of new specialized techniques includes ultraviolet, infrared, phase and electron photomicrography. Also provided are descriptions of equipment and conventional techniques for making photomicrographs with a compound microscope at low, medium and high magnifications.

Additional chapters deal with subject illumination, filters, professional and simple techniques, and exposure determination. For handy reference, a series of data sheets appear at the back of the book.

Transistor Circuits Powered From Radiated Energy

A 13-page report of Army research describing the principle and circuitry for powering electronic devices entirely from electromagnetic energy radiated from distant sources is now available from the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C. Designated PB 131264, a copy may be obtained at a cost of 50c.

Emphasis is given in the report to the use of a transistor amplifier in the system to provide remote switching of power to a load. Complete instructions are given for construction of a standard broadcast radio receiver operating on this principle. Circuit arrangements are described for storing dc power, for withdrawing the stored power at selected rates and amplitudes, for changing power from dc to ac and for applying the required power to various devices.

Career Opportunities In Electronics

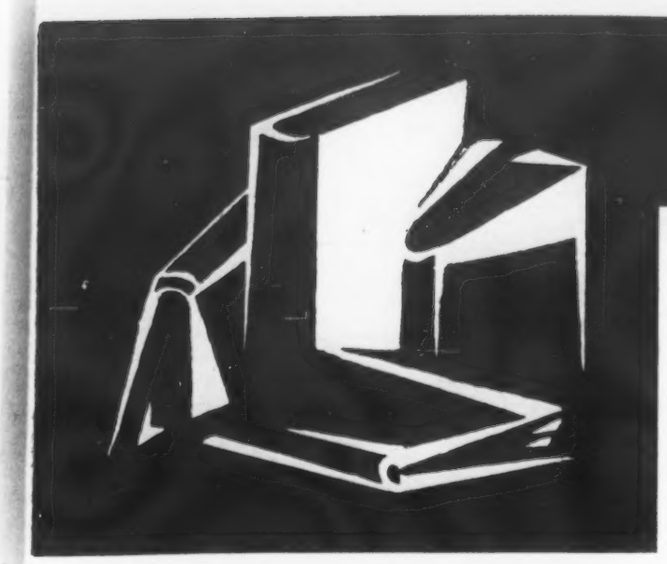
Analysis of an industry-wide survey, recently undertaken by the Cleveland Institute of Radio Electronics (CIRE), indicates that the expansion of job opportunities in the electronics industry during the past 10 years will increase still further to match the pace of development in such fields as mobile radio installation, radio and TV broadcasting, military, airline and industrial electronics.

An informative 24-page booklet, entitled "Opportunities in Electronics for You," has been designed to provide pictorial coverage of such opportunities together with succinct descriptions of those employment openings presently available. At no cost, it may be obtained from CIRE, 4900 Euclid Ave., Cleveland 3, Ohio.

24 Electronics Projects

Describing 24 military and industrial electronics projects, a new 8-page booklet entitled "Technical Project Summaries" has been prepared by Pickard & Burns, Inc., 240 Highland Ave., Needham 94, Mass. Individuals may, on company letterhead, request copies from the above address, free of charge.

Project solutions relate to missile telemetry, high-accuracy radio navigation, radio wave propagation, microwave antennas and components, radar surveillance and direction finding, airborne weather radar, electronic circuit development together with allied subjects.



Books

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA. D. Van Nostrand Co., Inc., Princeton. N.J. 1839 pages, 11" x 8½", $26.85 until 3/17/58—thereafter, $30.00.

Now in its third edition, the Van Nostrand scientific and engineering encyclopedia offers an outstanding coverage of the major sciences and fields of technology in a convenient one-volume work.

Highly recommended to both the professional and the layman, the encyclopedia houses 14-thousand lucid, succinct and accurate articles which not only treat fundamental principles but also numerous practical applications in such modern fields as atomic energy, penetration of outer space, and biochemistry where frontiers against disease are steadily being advanced.

An effective plan of cross-referencing knits together articles concerned with any chosen subject. Enhancing the presentation are 1400 illustrations in both color and in black and white.

SOLDIERS OF THE STATES, William H. Riker. Public Affairs Press, Washington 3, D.C. 129 pages, $3.25.

Mr. Riker's penetrating exposition of the role of the National Guard in American Democracy is an especially timely effort in view of recent controversies between the state and the Federal Government concerning states' rights and the proper roles of the Army and the National Guard.

Supported by grants from the Rockefeller Foundation and the Social Science Research Council, the author's research for this work has resulted in a discerning treatment of the National Guard's origin and development, its traditional responsibilities to the states and the Federal Government, and its present status in terms of total defense.

The work presents a fascinating history of the U. S. military policy combined with a study of American federalism and a significant analysis of constitutional problems involved.

SCIENCE IN THE FEDERAL GOVERNMENT, by A. Hunter Dupree. Belknap Press of Harvard University Press, Cambridge, Mass. 460 pages, $7.50.

A study of great service to those eager to examine the historical beginnings of scientific activities in our Government, Mr. Dupree's book traces from the beginnings through to the year 1940 the Nation's policies and efforts in scientific works.

Of considerable interest are such disclosures as the circumstances and conflicts preceeding the establishment of scientific organizations such as the Smithsonian Institution and the apprehension concerned with whether the Government under the Constitution should undertake science at all since it provides specifically only for the granting of patents.

In his absorbing account of the gradual advancement of science to the present state where even pure scientific research constitutes a vital national resource, Mr. Dupree has entered a timely book on a scene where our Government-science partnership is perhaps of greater significance than ever before.

MARINE ELECTRICAL PRACTICE, by G. O. Watson. Philosophical Library, Inc., New York 16, N.Y. 325 pages, $12.00.

For the marine engineer who has mastered fundamental principles and is now concerned with practical problems, Mr. Watson's book offers a comprehensive coverage of marine electrical practice including treatment of A. C. generators and switchgear—a subject of growing importance with regard to marine installations.

Other subject areas include motors and motor control, batteries, lighting, cables and distribution, together with electrically-driven auxiliaries such as steering-gear.

The work is believed to be of great assistance to engineers studying for the Ministry of Transport examinations, as well as a practical aid to electrical draughtsmen, seagoing engineers and those engaged in the installation, maintenance or operation of marine electrical equipment.

WEST POINT TODAY, by Kendall Banning and A. C. M. Azoy. Coward-McCann, Inc., New York. 256 pages, $3.95.

Written by the late Lt. Col. Banning and revised and edited by Col. Azoy, *West Point Today* opens with a graphic description of the first-year trials endured by "Mr. Dumbjohn," a typical cadet.

A discussion follows, in the form of several chapters, distinguishing those features which contrast the Academy with civilian colleges: its system of teaching and its curriculum; the Cadet Corps' organization and discipline; its honor system; its program of physical training.

Of special practical value is the detailed listing of the paintings, monuments and historical objects to be found on the Academy grounds.

A SECOND SURVEY OF DOMESTIC ELECTRONIC DIGITAL COMPUTING SYSTEMS, by M. H. Weik. Office of Technical Services. Dept. of Commerce, Washington 25, D. C. 439 pages, $7.00.

The Army's new report, authored by Mr. Weik of the Ballistic Research Labs, Aberdeen Proving Ground, offers a complete coverage of the engineering and programing characteristics of 103 commercially available digital computing systems. The publication supercedes an earlier one prepared in 1955.

An excellent guide for potential users of such equipment, the work provides material concerning applications, cost, personnel requirements, and power and space requirements for specific systems. Reliability problems are treated and suggestions are offered on modifications and improvements useful to those presently operating digital systems.

Together with an analysis of all data gathered from the survey preceding the report, there is included comparative tables, a discussion of trends, a bibliography and a complete glossary of computer engineering and programming terminology.

AN ENCYCLOPEDIA OF THE IRON AND STEEL INDUSTRY, by A. K. Osborne. Philosophical Library, New York. $25.00.

With the desire to satisfy the wishes of many associates, Mr. Osborne has published an outstanding reference book to provide a concise description of the materials, tools and processes used in the iron and steel industry. It is a collection of material which has been assembled over more than a quarter of a century. The book is a library within itself of information which cannot be matched in any other publication of this nature. It is highly recommended and of particular value to smaller firms which have not as yet invested in a library program. Student libraries, executives and workers will find Mr. Osborne's contribution worth the modest investment of $25.00.

(*Continued from page 7*)

The Soviets will try to triple their production of radio engineering instruments by 1960. They have taken stern steps to build up precision measurement in their factories. They are working diligently to get into a competitive industrial position with the United States.

The Russians are building 129 regional calibration centers. These will have the responsibility of taking the latest findings in measurement research and imposing precision production on their machine producing plants. They have made significant advances in instrument development.

I warn industrial executives that this Soviet Five-Year plan is a serious challenge to the United States. We are in a grim, prolonged contest for world economic leadership. We have a good lead, but we have to put on additional steam to keep it.

American Pioneers in Measurement

Even if there were no stepped-up competition from the Red world, the rapid, forward surge of science and technology compels our Nation to strengthen its measurement and calibration programs.

Every manufacturer knows we are old hands at this game. About 150 years ago, Eli Whitney, inventor of the cotton gin, sparked an even greater industrial revolution by his concept of interchangeable parts. Previously, gun makers laboriously filed and scraped pieces to fit. Whitney introduced jigs, dies and gages so that any quantity of different parts could be manufactured to conform to previously determined shapes and sizes.

By thus bringing accurate scientific measurement into the factory, Whitney provided the key for modern mass production. Since then, the efficiency of technological industry has increased in proportion to greater control of dimensional tolerances.

New Demands on NBS

The National Bureau of Standards of the Commerce Department is responsible for the national standards of physical measurement from which are calibrated the measurement standards of the country. For example, the Bureau issues standards of purity or composition against which industrial production, such as steel production, checks its products.

The Bureau also acts as a national laboratory, conducting research in measurement, determining properties of basic materials, and providing other related advice and service to science, industry and Government.

But today requirements are much more complex and extensive than when measures dealt simply with pounds, feet and quarts. Today, electrical, chemical, electronic, light and nuclear radiation measurement techniques are necessary.

In 1953, I appointed a distinguished group of scientists, under the chairmanship of Dr. Mervin J. Kelly of Bell Telephone Laboratories, to study how the Bureau could best serve the Nation in the light of modern needs. As a result of this committee's recommendations and of plans by Dr. Astin, Director of the National Bureau of Standards, and the Bureau's fine staff, we were able to get some Congressional support—but never in the amount I felt was clearly indicated.

This year, I shall again ask Congress for a substantial increase in the basic research budget of the National Bureau of Standards. In this field of precision measurement—the indispensable key to our progress—I think this country can afford no longer to wait.

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This Talos launching from the RCA Defense System on Dec. 13, 1957, resulted in direct hit on distant drone plane.

The RCA Talos Defense System is the first *completely automatic* land-based system for launching and guiding missiles, and utilizes the Talos Missile developed by the Applied Physics Laboratory and produced by Bendix. The Defense Unit receives target signals from remote outposts, analyzes them with regard to number of attackers, location, course and speed. Next, computers determine the logical points of interception, order the missiles loaded on launchers, guide them at supersonic speed to the vicinity of the target, after which the missiles "lock" on the target and close in for its destruction. All without even the touch of a button! The RCA Talos Defense System, with its electronic equipment and guidance systems, was designed, developed and built by RCA as prime contractor, aided by many subcontractors. It was turned over to the U. S. Army on October 15, 1957, and is a missile milestone, exemplifying the continuing determination of American enterprise to secure peace with honor and justice.

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According to an old Croatian fable, the first experimental radar station was installed 102,000 years ago last Thursday by a tribe of Cro-Magnons. But no sooner had the station been erected than a dinosaur appeared on the scene and gulped down everyone in sight —everyone but one badly frightened survivor.

"Tell the truth, man," the dinosaur said, "or I'll make Filet Cro-Magnon out of you. What is this mess of bones

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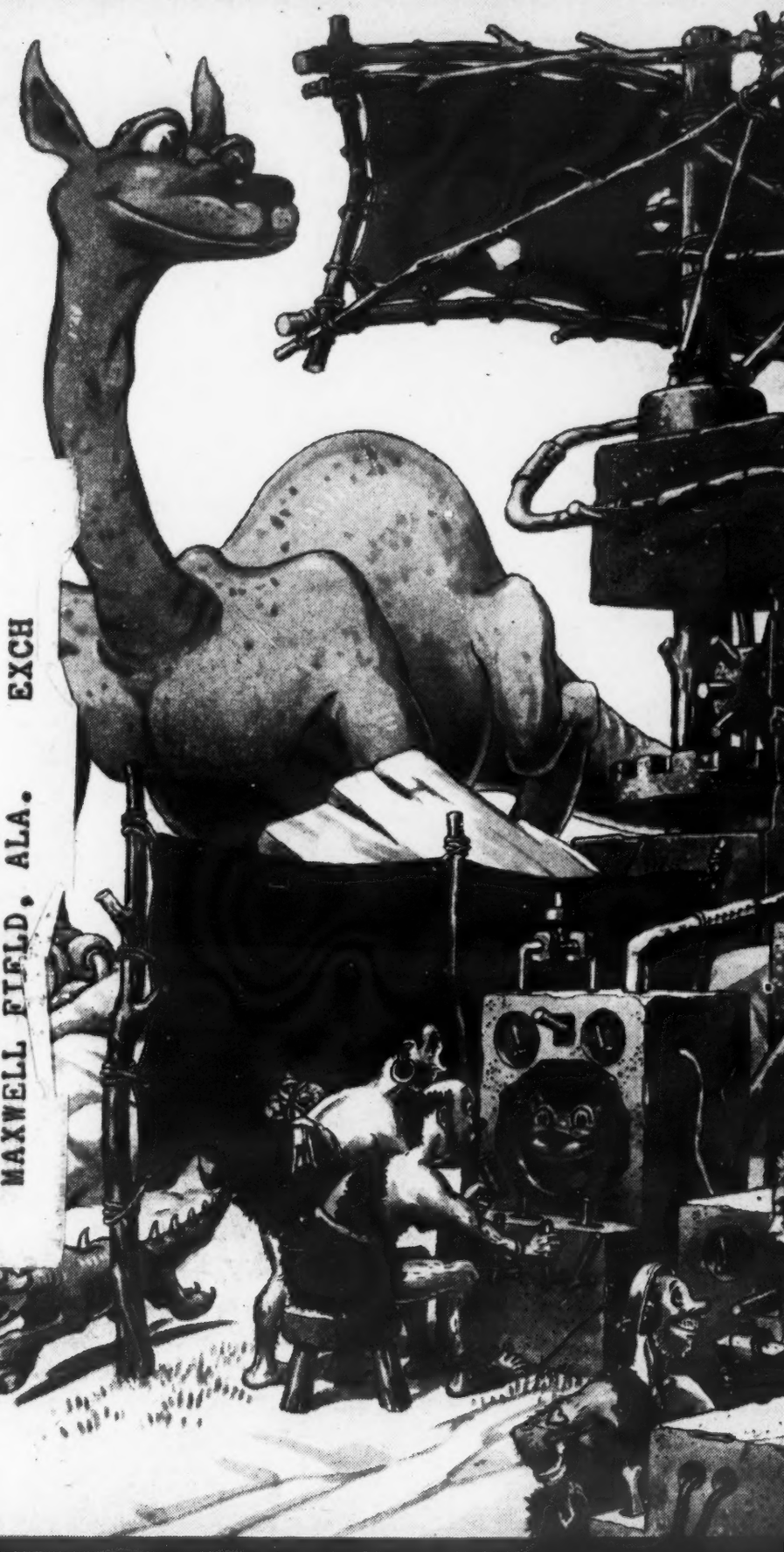

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and stones you have here?"

"Ra-ra-radar," was the weak reply.

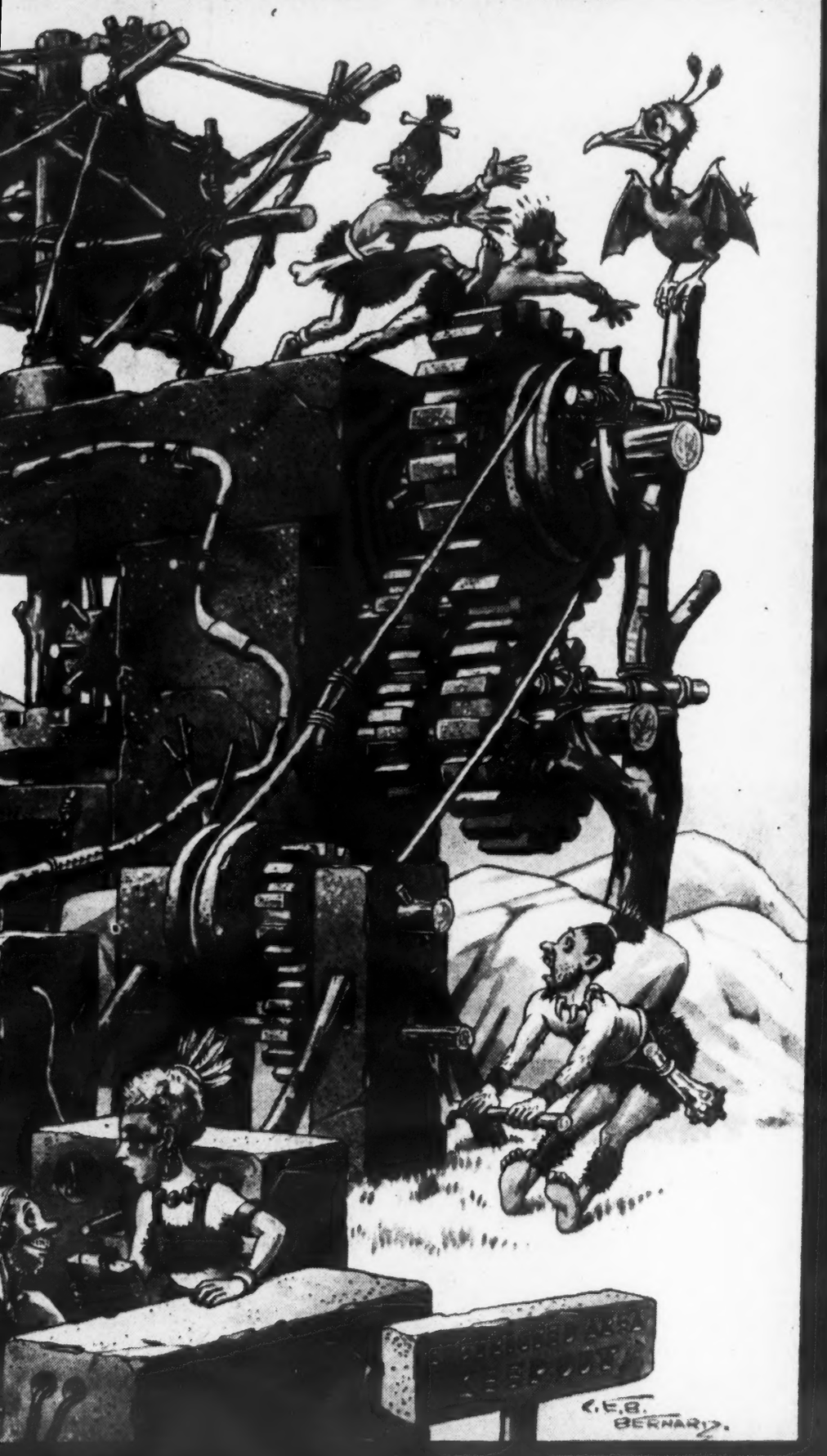
"Tell me another one," the dinosaur snorted. "If this is radar, I'm a ring-tailed brontosaurus. Does it use Bomac tubes?"*

"No . . . but . . ."

"That does it," the dinosaur said. "Whoever heard of a radar set without Bomac tubes?" He opened his mouth wide.

"Whoever heard of a talking dinosaur?" the man asked. But he was too far inside the dinosaur to hear the answer.

)AR THROUGH THE AGES



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